March, 1946

EDISON ELECTRIC INSTITUTE BULLETIN

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GEOGRAPHY, RESOURCES & INDUSTRIES

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THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

December, 1944-1945

SOURCE AND DISPOSAL OF ENERGY (In Kilowatthours)—MONTH OF DECEMBER

	1945	1944	%
GENERATION* (Net)			
By Fuel Burning Plants	11,522,230,000	13,401,682,000	−14.0
By Water Power Plants	6,578,994,000	6,200,651,000	+ 6.1
Total Generation	**18,101,224,000**	**19,602,333,000**	**− 7.7**
Add—Net Imports Over International Boundaries	152,787,000	122,802,000	+24.4
Less—Company Use	141,126,000	150,855,000	− 6.4
Less—Energy Used by Producer	121,434,000	13,783,000	.....
Net Energy for Distribution	**17,991,451,000**	**19,560,497,000**	**− 8.0**
Losses and Unaccounted for	2,707,962,000	2,616,522,000	+ 3.5
Sales to Ultimate Customers	**15,283,489,000**	**16,943,975,000**	**− 9.8**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of December 31st			
Residential or Domestic	28,116,998	27,371,260	+ 2.7
Rural (Distinct Rural Rates)	1,234,441	1,144,241	+ 7.9
Commercial or Industrial:			
Small Light and Power	4,398,184	4,263,395	+ 3.3
Large Light and Power	162,338	151,652	
Other Customers	119,112	117,844	.....
Total Ultimate Customers	**34,031,073**	**33,048,392**	**+ 3.0**
KILOWATTHOUR SALES—During Month of December			
Residential or Domestic	3,275,453,000	2,895,721,000	+13.1
Rural (Distinct Rural Rates)	263,802,000	224,005,000	+17.8
Commercial or Industrial:			
Small Light and Power	2,662,651,000	2,641,855,000	+ 0.8
Large Light and Power	7,561,140,000	9,480,688,000	−20.2
Street and Highway Lighting	222,849,000	219,760,000	+ 1.4
Other Public Authorities	539,771,000	695,839,000	−22.4
Railways and Railroads:			
Street and Interurban Railways	460,451,000	458,963,000	+ 0.3
Electrified Steam Railroads	241,547,000	249,092,000	− 3.0
Interdepartmental	55,825,000	78,052,000	−28.5
Total to Ultimate Customers	**15,283,489,000**	**16,943,975,000**	**− 9.8**
Revenue from Ultimate Customers	**$284,844,600**	**$279,632,900**	**+ 1.9**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—for 12 months ended December 31st			
Kilowatthours per Customer	1,229	1,151	+ 6.8
Average Annual Bill	$41.91	$40.40	+ 3.7
Revenue per Kilowatthour	3.41¢	3.51¢	− 2.8

(*)By courtesy of the Federal Power Commission.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 14 MARCH 1946 No. 3

Till Those Acres of Diamonds—Near Your Home

By V. W. Hartley

Managing Director, Pacific Coast Electrical Association

Excerpts from an address at the 10th Annual Conference of the International Association of Electrical Leagues

EVERY day most of us make a trip from where we work to where we get lunch. Everything about us is so familiar that we go along in a state of mental rest. This is because we have not developed the knack of asking intelligent questions. If we are really hungry—and if our only chance of getting something to eat depended upon our developing some business along this familiar road—then we would be mentally alert, like the robin, who asks, "Where can I find a worm?"

Preston's Garage

Here is one of those places you pass every day. Suppose you could not have lunch—or any other meal—until you got the wherewithal to buy it through selling something to the owner of this garage. Your process of reasoning would be something like this: "Boy, I'm hungry! When do I eat? What have I got that Jim Preston can use? How can I persuade him to buy it? WHAT? WHERE? WHEN? WHY? HOW?

Men at Work

During the next few years business for us in the electrical industry is going to be promoted by poking around in familiar places and asking intelligent questions. It will come through the remodeling or modernization of existing stores and shops and factories rather than from brand new customers in these fields. The man who can poke around and ask the most questions of the greatest assortment of the right people is going to get the highest percentage of the most desirable business. First we must ask ourselves, "What have we to offer?" and follow that by "Who can use it to his personal advantage and profit?"

Streamliner

When we speak of modernization some of us are disposed to think of the revamping of the old Call Building in San Francisco, or the old Masonic Temple Building on State Street in Chicago, or the Union Pacific streamliners, or highway underpasses, or some other big league job. Have you ever thought of the amount of electrical modernization that needs to be done right in your own neighborhood? Have you ever done anything about it? Would you like to get a few nice jobs without too much cutthroat underbidding? When are you going to start?

Casting Stereotypes

For instance, there is at least one newspaper in almost every town. How many questions can you ask about the applications of electricity to the production of a newspaper and its allied products? Try it some time with the idea that you must ask and answer them before you can get another meal. Remember the robin. Here are a few as a starter.

Linotype

How many do they have? How do they heat the metal? Would electricity be better? Quicker? Safer? Cheaper? More comfortable? What nearby plant using electricity can be used for a reference? Even in the smallest communities newspaper publishers are alert to modern methods for they must produce a paper satisfactory in appearance to hold the interest of their subscribers against larger papers from nearby cities. Don't try to sell this type of equipment without first learning something about how the newspaper of today is produced.

Mat Former

Do they cast stereotypes? Do they make mats? How do they dry them? Do they have a dark room? Do they use glue? Wax? Special inks? Is their switchboard up to date? What do I know about printing, anyhow? Where does electricity fit in? Where can I find out?

Printing Plant

There are few newspapers that do not have job printing plants in connection, using various types of small presses, where speed and accuracy are essential if this man is to get business in competition with nearby modern plants. Also, in most communities you will find large presses which are susceptible to the very latest electrical developments. Ask yourselves a batch of questions about printing establishments of this sort: How many are there in my territory? What do I know about them? Have I ever called on them? What would I say if I did call? Who is the smart fellow who is going to get this business if I don't go after it?

Motors

What do you know about new apparatus—new applications—new electrical gadgets that can be sold in this town? Have you heard of this new splash-proof motor? Is it designed for use in those places where it is particularly difficult to protect a motor from

outside moisture? Do any of your customers need such a motor? Can they learn about it if you do not tell them? Could you make this the opening wedge for a modernization job?

Door Openers

For that is what is needed to start this work of electrical modernization. Only in rare instances will a man listen to a proposal for the complete overhauling of his plant. But every wide-awake businessman knows what is going on in his particular line—he knows about new methods and processes and the mechanical devices that make them possible. He is always comparing his production costs with those of his competitors. He plans — eventually — to bring about some changes in his own place. But he is not going to welcome you with open arms. So it is necessary to have an opening wedge, a so-called door-opener.

Furnaces

Maybe something like this would do the trick. This small electric shaker-hearth furnace hardens blades for pocket knives. Any plant that does things with tool steel is always ready to listen to a story about better methods for heat treatment because this part of their production process can make or break their reputation.

Infra-red Lamps

Here is another that will open the door in any plant using paint, enamel, varnish or lacquer. It is the new, infra-red lamp for low temperature drying. It has dozens of applications, is inexpensive, easy to demonstrate and inevitably will suggest other items which we have to sell and which the many industrial customers in our town need.

Enclosed Motors

Or your device for promoting new business might be this totally enclosed, explosion-proof motor. It is filled with inert gas and cannot make even the tiniest external spark. Where will it be sold? In oil refineries and other places where there is a possibility of an explosive gas being set off by an electric spark. There may not be many prospects for this new motor in your particular trade area, but think them over before you say there are none. When you find one, you have the finest possible entering wedge with this enclosed motor.

Transformers

While you are asking yourself questions about what you will use as an approach to some customer whom you would like to interest in electrical modernization, don't overlook this new type transformer which is filled with a non-inflammable liquid in place of the ordinary oil. Transformers of the conventional type, when installed indoors, have to be enclosed in large and expensive fireproof vaults. The new type can be installed anywhere—for example, in the roof structure. Or they may be installed right on the factory floor, requiring only a railing or grille work to avoid personal contact. They offer many ideas to any man who wants to cut down the length of feeders on a rewiring job. It's another good opening wedge.

Capacitors

What do you know about power factor? Would you be willing to learn, provided it opened the door to a few nice jobs? What causes poor power factor? How can it be corrected? There isn't time to go into it now, but you can learn a lot in thirty minutes of the right kind of reading. Here's something that's as modern as tomorrow. It's the capacitor—a device for correcting power factor.

Sawdust Bin

How many places are there in your town where electroplating is done? Don't you know? Maybe it would be interesting to find out. This is a business that consists of handling a lot of small parts, many times, for a very small charge. The part may be a screw from a headlight frame, yet it must be handled just as many times as a big part—like a bumper. It must be cleaned, plated, rinsed, dried, polished and lacquered. Such a plant must measure its economies in fractions of a cent, hence it is an ideal place to tell a modernization story. A sawdust bin is used for drying plated parts. Damp sawdust slows up the process, so this bin has been improved by installing electric strip heaters.

Rinse Tank

In this plant caustic soda and water rinse tanks are kept at a constant high temperature by three immersion heaters in each unit. An insulated cover is placed over the tanks at night and a time switch set to turn on the heat several hours before work begins. No time is lost for proper temperature when workmen arrive.

Spray Booth

Does anybody in your town make toys? How many cabinetmakers do you know? Is there a factory making novelty furniture? Are there any sign painters in your neighborhood? In other words, do you know how many places there are in your trade area where spraying outfits are used for painting processes? It might be a good idea to find out because every one of them offers a chance to tell the modernization story.

Painting Autos

Here is a modern shop for refinishing automobiles with lacquer spray. Do you know the special rules covering this type of installation? Do you realize how much energy for lighting and ventilation such a booth requires in addition to the compressor for the spray? These lacquers are so highly volatile that no electrical device of any sort whatever is allowed within the booth. The lighting comes through windows, and all power equipment is on the outside. Does it look like good business? Would you like to get some of it? Do you know where to get the special rules?

How does a fellow go about it to get the kind of business that has been shown in the last seven paragraphs? By knowing how to ask intelligent questions. Remember the reporter. He knows where to go for the news and he knows the kinds of questions to ask when he gets there. He isn't bashful—he knows that few men have been shot for being politely inquisitive. Furthermore, he knows that his bread and butter depend upon his ability to get what he is after. Selling ideas for electrical modernization is like that.

Factory

There is money for you behind these walls. But if you are to get some of it you must constantly ask questions. WHO? WHERE? WHEN? HOW? WHY? What do these fellows do? How do they do it? Why do they do it that way? Is there a better way? Do I know all about it? Where can I find out? What shall I use for an opening wedge? Does this place need better lighting? Do they do welding? Grinding? Annealing? Soldering? Do they use glue? Spelter? Wax? Should they have automatic control? How do they ship their stuff? How is it packed? Can they

use conveyors? Lift trucks? Stackers? The electrical man who can prowl around and ask questions like these has the jump on the fellow who spends his time scanning the building permits and using all his evenings to figure bids on competitive jobs.

Welding

How long would it take you to make a survey of the number of places in your neighborhood that do welding? Could you do it in half a day? Would a prospect list like that be interesting? Welding is the modern way for making new things and fixing old ones. Much of it is done by methods which are inferior to the electrical way. Welding involves the use of heavy equipment—big cables, big switches, big accessories. To get it, you have to go after it in a big way. It can't be sold by pikers.

Compressors

What about the meat business in your town? It involves the use of electrical apparatus all along the line. Have you ever thought about it? Here we see the compressor units which provide air conditioning in a factory that makes three and one-half million pounds of sausage in a year. Now please don't say, "That's a lot of bologna!" Modern methods of meat handling require precise operations of the type that can best be handled by electricity. So why not sit down for half an hour and ask yourself a bunch of questions about the meat business in your neighborhood?

Who raises beef? Sheep? Hogs? Do they chop hay? Grind corn? How about silos? Where do they keep their meat? How is it refrigerated? What machinery do they use to handle by-products? Do they cook their products? How do they heat water? How many retail shops are there? Are they modern? Do they need better refrigeration? Is their lighting up to date? How are they fixed for grinders and cutters? Electric signs? Electric clock? Outlets for cash registers and scales? Do they handle fish? Oysters? Cottage cheese? Who makes it? How?

Poultry Storage

Do they handle poultry? How do they heat water? Who raises the fowls? Do they use electric incubators? Electric brooders? Do they grind their own feed? Have they modern refrigeration? Are their chicken houses well lighted? How many restaurants and hotels in your town? Do they use meat? How do they cook it? Have you told them the advantages of the electric way? Boy, when you can learn to ask questions like these—intelligent questions that lead somewhere—you are on the road to a brand new method of getting business.

Man at Telephone

But your questions must be well directed—and sooner or later they will lead to something you can't answer. You are not supposed to know all the ramifications of some of the highly specialized processes we have discussed. Then what do you do? Simply this—ask more questions. Ask the wholesaler's salesman who calls on you. Ask the manufacturer's representative. Ask the power company's specialists. Ask the specialty salesman who devotes his time to a single line—water heaters, for example. Ask yourself, "Who knows about this? Where can I reach him? When will he come? What will I do then?" WHO? WHAT? WHERE? WHEN? HOW? WHY?

Projection Booth

How long is it since you have prowled around in the theaters in your town? What do you know about the electrical devices that go into a modern theater? The theater, more than any other business, has to have the appearance of being right up-to-the-minute. How about these in your district? When a showplace closes, study the situation and tell the owner why it went bad and what is necessary to open it up again and make it pay. Talk air conditioning—lighting — signs — decorations — projection — novelties. Ask yourself a bunch of questions and then get the answers. That's the way the reporter gets news. That's why the robin gets the worm.

Bottling Machine

The preparation of bottled goods has become almost automatic in the modern plant, with electrical processes expediting every operation. Have you ever investigated the bottling business in your district? Is there a brewery? Or maybe a winery? Does somebody handle Coca-Cola, or Seven Up or any of the popular soft drinks? Of course, there are several dairies. What do you know about them? Have you ever told them how keen competition may be made by adopting truly modern methods? Do you know how electricity is used in dairies for sterilizing, pasteurizing, bottling, capping, refrigeratng? It's somethng to think about some day when things are quiet around the office. We'll pass that for a moment to look into another industry that is found in every community.

Greenhouse

Here is a nice little business of raising gardenias for the market. Uniform growth is managed by regulating the temperature both of the surrounding air and the soil in which the tiny rootlets are feeling their way. Heating cable laid in the soil is paying dividends. This is one of those specialized applications that calls for the advice of an expert. There is one near you. Do you know him? Do you know all the owners of greenhouses in your town and suburbs? Why not bring the two together? The greenhouse needs other electrical devices, too—pumps for pressure spraying—woodworking tools—office lighting—electric signs. Have you ever asked yourself a bunch of questions about getting some business from this interesting industry?

Brass Furnace

Are there any foundries in your neighborhood? Have you passed them up because they don't look important? Have you ever investigated what they make and how they do it? Do you know that no other process can touch electricity when it comes to making fine castings? For instance, there is available a brass furnace that will handle 425 pounds of metal in thirty minutes, with perfect temperature control. Good foundry practice saves dollars in the finishing shop. Do you know where to get the dope on this? Are you interested? It's your move.

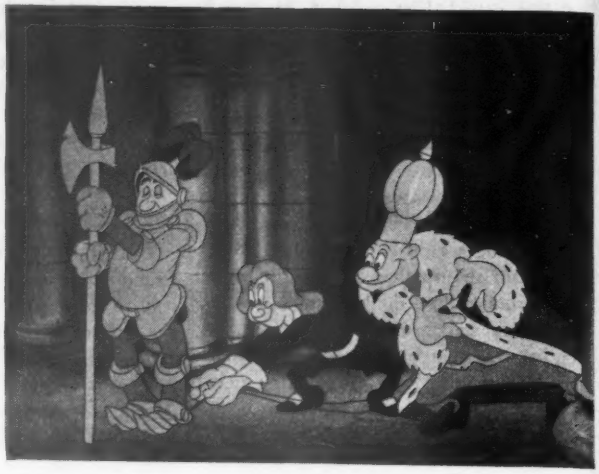
Circuit Breaker

In strictly modern installations, fuses are now a thing of the past for overload protection. In their place we have the air circuit breaker—a thoroughly reliable device which responds quickly to an overload and which likewise may be quickly reset. What do you know about them? Are you familiar with their characteristics? Do you know what they cost? Are you prepared to demonstrate them? How many places in your trade area can use them?

The circuit breaker is a business-like appearing device. Sturdy in construction and yet extremely sensitive. There is a market for it among the large customers

(*Continued on page 70*)

An early scientist, delving into the nature of electricity, encounters a heckler.



Could this have been Reddy's first residential service—a new-fangled hot foot?

Reddy Kilowatt Stars in Technicolor Film

History of Electricity, Sidelights on Present Service Dramatized in Popular Cartoon Technique

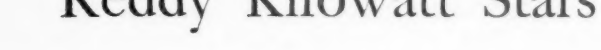
REDDY KILOWATT goes Hollywood in a ten-minute Technicolor and sound cartoon, which informally portrays episodes in the history of electricity and dramatizes present-day electric service. The film will soon be available for distribution, according to Ash Collins.

Prepared in both 16 and 35mm., the film will be non-commercial and entirely educational, suitable for use in churches, schools and clubs, as well as theatres.

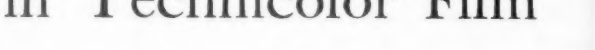
Produced by Walter Lantz Productions, of Hollywood, the film features specially written music and a clever Reddy Kilowatt song. Walter Tetley, the "LeRoy" of the Great Gildersleeve radio show, is Reddy's voice.

In addition to presenting sidelights of the epic of electricity, the film illustrates the modern system of distribution from generating station through transmission lines to substation, and into the "Reddybox" where the user can always plug in and find Reddy ready. The film concludes with a brief description of Reddy's many services in the home.

Information on the film is available from Reddy Kilowatt Service, 30 Church St., New York, N. Y.



Reddy really begins to go places, when Faraday discovers the continuous current.



Years of development produce modern electrical living—Reddy shows how it's done.

Illumination in Generating Stations

By E. B. Shew

Philadelphia Electric Company

Presented before a meeting of the Electrical Equipment Committee, EEI, Cincinnati, O., Feb. 20-21, 1946

FEW THINGS seem to be so readily accepted and yet so little understood as good illumination, due probably to one or more of the following:—Inability to visually appraise levels of illumination, lack of a good basis for comparison, growing appreciation of suitable forms of increased illumination, differences in visual acuity, and the ability of the human eye to function perseveringly even at ridiculously low levels.

The problem is further complicated by the differing characteristics of lighting equipment and its application, the higher levels which exist initially only, and that slow insidious robber of illumination known as depreciation. Few persons, however, will fail to recognize that the Generating Station has been no exception in the inability to possess good illumination for one or more of the above reasons. The problem of illuminating the new Southwark Generating Station together with a need of improved illumination in a number of existing Generating Stations has forcibly called these factors to our attention.

The existing Generating Stations are generally lighted by incandescent lamps except for a few cases where mercury vapor lamps have been introduced recently. Incandescent lamps have usually been installed in open type glass reflectors in the switchhouses, in high bay dust-tight units in Turbine Halls and RLM dome type open baked enamel reflectors in Boiler Houses. The open type glass reflector units in switchhouses have not been entirely satisfactory since this type unit is not functionally suited to the long narrow and usually high operating aisles which generally exist. The RLM type fixtures in Boiler Houses have not been satisfactory because of the deterioration of the reflecting surface in unfavorable atmosphere.

Most of our turbine halls were originally equipped with open type silvered glass high bay units which proved unsatisfactory due to cracking of the glass and peeling of the silver from heat in addition to a rapid accumulation of dirt which resulted in almost complete depreciation. Five or six years ago these were almost entirely replaced with dust-tight high bay units with Alzak reflectors and 1500 w lamps. No regular maintenance program has been in effect other than the replacement of burned out lamps and cleaning of fixtures at that time. Data at one turbine hall where initial values are available indicates a depreciation of 35 per cent in illumination over a five year period. Cleaning the units and replacing darkened lamps restored the installation to 60 per cent of the initial values.

Investigation of the reflecting surfaces of similar units in another station indicated no noticeable depreciation. However, replacement with the same type reflectors in two units after cleaning and relamping indicated a 20 per cent increase in illumination below the units due to the change in reflectors. It is not known whether this represents depreciation of the original reflector or improvement in the design or material of the new reflectors or a combination of both.

No voltage regulation has been installed in existing stations and the voltage variation at the light and power bus is usually between 118 and 125 volts. The total voltage drop in feeders and branch circuits has been generally limited to 3 per cent by design. Lamps rated at 125 volts have been considered standard for use in existing Generating Stations. While this has undoubtedly prolonged lamp life, it is now believed that this has been accompanied by a severe loss of illumination and consideration is now being given to the possibilities of using lamps with more appropriate voltage ratings in these stations.

Characteristic incandescent lamp curves indicate that while life is increased at least ten times as fast as voltage is reduced within normal limits, initial illumination output is reduced at three times the voltage rate. Since depreciation is primarily due to vaporization of the filament due to current and burning hours, it is interesting to note that the current is reduced at only two-thirds the rate the voltage is reduced and since the burning hours are increased at roughly ten times this rate the lamp depreciation due to operation below rated voltage is likely to be greater than would be expected at rated voltage and life. With the supply at a minimum of 118 volts, 3 per cent drop in the feeders and circuits would produce an additional loss of 25 per cent in initial illumination on 125 volt lamps. While it is recognized that not all the lamps will burn out at the same time or suffer minimum voltage conditions all the time still an average of even half these losses are believed to be higher than should reasonably be permitted. The extension of lamp life has the effect of prolonging cleaning periods which results in a still higher depreciation due to accumulation of dirt. In addition, the use of 1500 watt lamps in the Turbine Hall high bay units is not considered desirable since the depreciation in these lamps is roughly 1.5 to 2.5 times that for 1000 watt or 750 watt lamps.

Because of difficulties encountered in presenting and properly supporting the various factors affecting depreciation and loss of illumination in particular areas, the lack of complete operating data and the controversy involved in discussing initial and maintained values it has been found desirable to develop a term and definition to comprehensively express the illumination in any area. This we have called "Service Illumination," defined as the average illumination measured in foot candles which exists in an area after a lighting installation has been in service long enough to reflect the maintenance program.

In a new generating station now under construction regulators will be installed since the estimated voltage variation at the lighting transformers was not considered satisfactory for suitable illumination, and on this basis the normal operating voltage on the lighting bus is expected to be 121 volts. The voltage drop in the lighting feeders will be limited to 1 per cent and in the branch circuits to 2 per cent. On this basis, voltages at the lighting equipment will not be more than 121 volts, or less than 117 volts, and it is planned to use 120 volt incandescent lamps; all other lighting facilities will be 115 volt equipment.

The high bay lighting in the Turbine Room and Heater Bay will consist of

twin dust-tight units equipped with one 750 watt incandescent lamp and one 400 watt mercury lamp. Service illumination here is expected to be 7 to 8 foot candles. Dust-proof incandescent units will be installed in the Boiler House and ground floor of the Turbine Room and Heater Bay. The principal boards in these areas will be equipped with incandescent lamps in a hood provided with control lenses. Twin mercury lamps in addition to incandescent lamps in dust-proof units are proposed for the machine shop.

The switchhouse equipment rooms and corridors will generally be illuminated by open tube cold cathode series lighting since this source of illumination is particularly well adapted to these areas. Other advantages which make this light source especially desirable are low brightness, long life particularly where the ratio of starting operations to burning hours is high, relatively low susceptibility to voltage variations and instant start no-blink characteristics without auxiliaries which are a frequent source of trouble. Light and Power Rooms and all locker rooms and wash rooms will be illuminated in the same manner. Service illumination in the equipment rooms is expected to be approximately 10 foot candles. Incandescent lamps will be limited largely to Battery Rooms, small machinery rooms, stairways, driveways and emergency lights.

It is planned to illuminate the Control Room with cold cathode tubes in semi-indirect semi-luminous fixtures suspended from the ceiling. Based on an experimental installation with various type fixtures and sources, the pattern, type, suspension, ceiling height and floor color were determined which would produce the most uniform illumination with a minimum of reflection and shadows. The estimated service illumination at desk level is 25 foot candles with 15 foot candles on the vertical boards.

The general office area will be equipped with cold cathode tubes in luminous indirect fixtures to provide a service illumination of 40 F. C.

A small amount of hot cathode fluorescent lighting will be installed where a fluorescent source is desired for uniformity but 8′ tubes cannot be readily accommodated.

Complete cleaning has been recommended three times a year and it is considered desirable to establish a complete record of the lighting equipment together with fixed bench marks at which foot candles and voltages can be checked initially and periodically thereafter.

IF EDISON TRIED IT TODAY

By H. I. Phillips

in his column in the New York *Sun*, The Sun Dial. ©The New York *Sun*

They celebrated the ninety-ninth anniversary of Tom Edison's birth the other day. We can't help wondering what a time the king of all inventors would have had if he were getting his start, say, in the last ten years.

* * *

You can almost picture Tom's struggles from there under present-day circumstances:

1. Invents an improvement on telegraph instrument. Is denounced by the Petrillo of that industry.

2. Insists on going to work at 6 A. M. and working long after hours. Is chased out of town.

3. Gets an idea for a talking machine but is denied materials.

4. Manages to get enough for one three-hour experiment and is summoned before OPA.

5. Is discovered in shop at sunrise and denounced as a heel who is thereby depriving somebody of a job.

* * *

6. Is found inventing as late as 10 P. M. and is blasted as a reactionary.

7. Perfects talking machine. Is denounced as a man who would rob thousands of singers, musicians, &c., of a living.

8. Gets an idea for a storage battery. Writes Washington to see if any such thing has been patented. Gets no answer for four years. Writes another and ultimately gets a reply meant for somebody who inquired about surplus property sales.

9. Perfects storage battery. Is denounced by teamsters, horsecar drivers, candlemakers and kerosene oil interests.

10. Gets idea for incandescent bulb. His experiments from early in morning until midnight in small workshop cause rumors that he is a foreign agent, a saboteur, an enemy of labor—and even a Republican!

* * *

11. Has to suspend further experiments because he "can't get the goods."

12. Further suspension necessary because of OPA rulings, walkouts, sit-down strikes and reconversion troubles.

13. Spends couple of years digging his way out of Federal questionnaires.

14. Appeals to Washington for 80 cents worth of stuff that may bring the electric light to civilization. After nine months gets a letter reading: "Dear Sir. Your inquiry regarding the probable duration of the American occupation of Germany has been received, &c." Writes another letter repeating his original request. Ultimately gets reply from some bureau saying "We have no record of your Uncle Joe being in a prison camp."

15. Burns up his laboratory, throws all his apparatus into the ash can, abandons further experiments and decides to enter politics.

Till Those Acres

(*Continued from page 67*)

in your neighborhood. Nearly every town has one big plant of some sort. It may be a packing house—or a railroad shop—or furniture factory—or an oil refinery—or a shipyard. There you can talk modernization in a big way.

Likewise, in homes, offices and stores we can sell the multi-breaker. Are you familiar with the wide variety of devices for that purpose? Do you know how to estimate them? Do you know how little is the difference in cost between the various types? Have you a sample for demonstration purposes? Do you know where to get one? How many architects are on your list? Do you talk modernization with them? Will you? When?

But for every big plant there are dozens of relatively small outfits. The owners of a small factory, doing work in some specialized line, are just as much concerned about profits as the big fellows. In fact, they need our services even more than the big producer for he can afford to employ his own experts. But it takes ingenuity to develop such business—it is not like taking orders for lamps and irons, or doing work to the owner's specifications.

How do we get some of that business that is literally waiting to be taken? By asking ourselves questions. By training ourselves to go around with our heads up and our eyes open. By being like the reporter who never knows where a question will lead him but being reasonably sure it will lead him somewhere. By assuming the attitude of the robin as he goes about looking for worms. By constantly being alert to opportunities for uncovering new business with our WHO? WHAT? WHERE? WHEN? HOW? WHY?

Transmission System Losses

By W. H. Osterle
West Penn Power Company

Presented before a Meeting of the Transmission and Distribution Committee, EEI.
Cincinnati, O., Feb. 18-19, 1946

I. The Problem

The West Penn Power Company serves some 250,000 customers in western Pennsylvania in an area of about 9,000 square miles. The peak load for 1945 was a little less than 450,000 kw with total sales of 2.6 billion kwhr. Two of our generating stations are located outside the state and about 70% of all energy sold flows over our 132-kv system.

A great deal of study has been given to our 132-kv system losses during the past years because, perhaps, we are always aware of their value since meters are read each month at the entrance to and the exit from the 132-kv system. This information is very useful in making Commission reports of our losses divided into transmission, distribution, and unaccounted for losses, and also for interstate accounting work. Furthermore, our generating units are operated in an interconnected system with our affiliated properties—The Potomac Edison Company, in Maryland, and the Monongahela Power Company in West Virginia, on a split saving basis, and transmission losses must be taken into consideration in such transactions.

Having the 132-kv system losses plotted by months we were concerned with their make-up, particularly what percentage were fixed losses and what percentage variable, so we attempted to calculate the 132-kv system losses by using monthly peak load conditions and a loss factor. In order to equal the total metered losses the loss factor required was always more than unity, which is impossible, so last March we decided to take detailed readings at every generating station and transmission station every hour for a period of one week to see if we could not obtain some new light and solve once and for all this baffling problem. Due to the high war-time loads the time seemed appropriate to make this study even though man power was scarce. Moreover, we had been adding new generating capacity to our system so that a study made prior to these additions would be helpful in future considerations.

I am here to describe this special study and to tell you the result, and to confess to you that we still cannot calculate sufficient loss to equal the metered values. Our unaccounted for losses during this test week ran about 37% of the total and equaled an average of 4,200 kw per hour. These unaccounted for losses, priced at a reasonable figure, amount to about $100,000 per year. We engineers, as bookkeepers, cannot find a little item of $100,000 in our balance sheet. Maybe we are just plain dumb; maybe we are the only company in the United States that has a leak of such magnitude, and yet we wonder if you too may have the same problem.

First of all let me define what we mean by our 132-kv-system. It is the lines and transformers from the 11-kv generator buses to our 25-kv sub transmission buses; it includes the stepup (11/132 kv) transformers; 132-kv transmission lines, and the stepdown (132/25 kv) transformers.

I would like to show you a few charts first to help visualize our system, and then to show the results obtained from our special test week. First of all, the magnitude of the Company output by months—

II. Magnitude and Variation

Chart 1 shows the total system losses and the output and sales. The abscissa

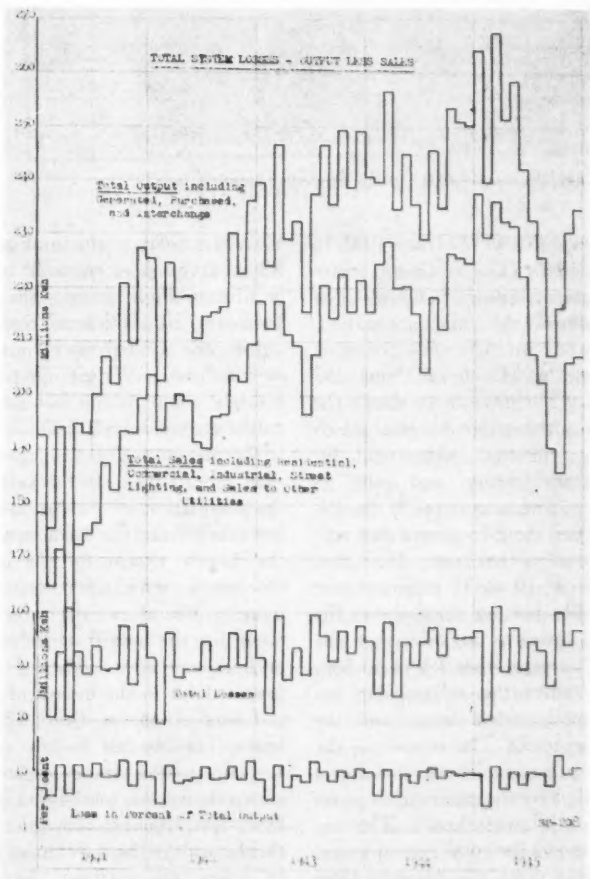

TOTAL SYSTEM LOSSES - OUTPUT LESS SALES
Total output including Generated, Purchased, and Interchange
Total Sales including Residential, Commercial, Industrial, Street Lighting, and Sales to other Utilities
Total Losses
Loss in Percent of Total Output

Chart 1—Total System Losses—Output Less Sales

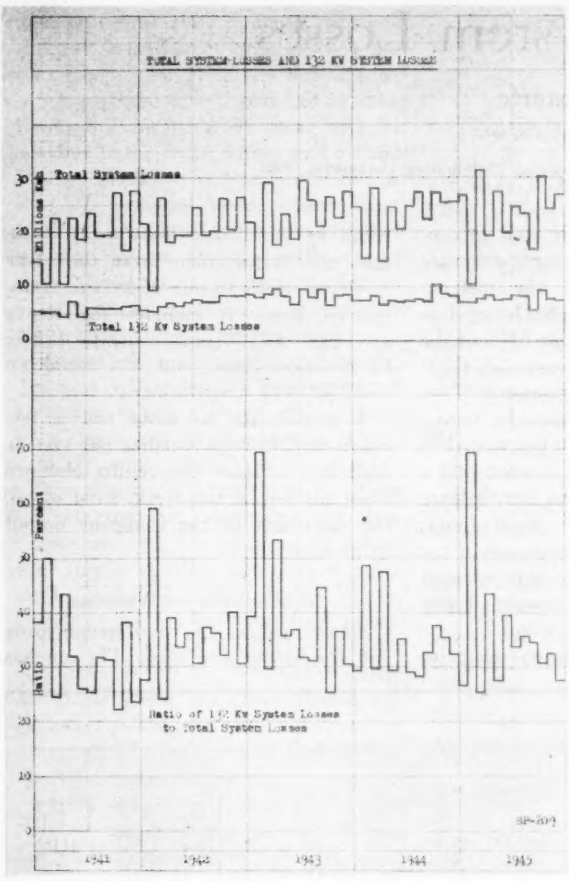


Chart 2—Total System Losses and 132-Kw System Losses

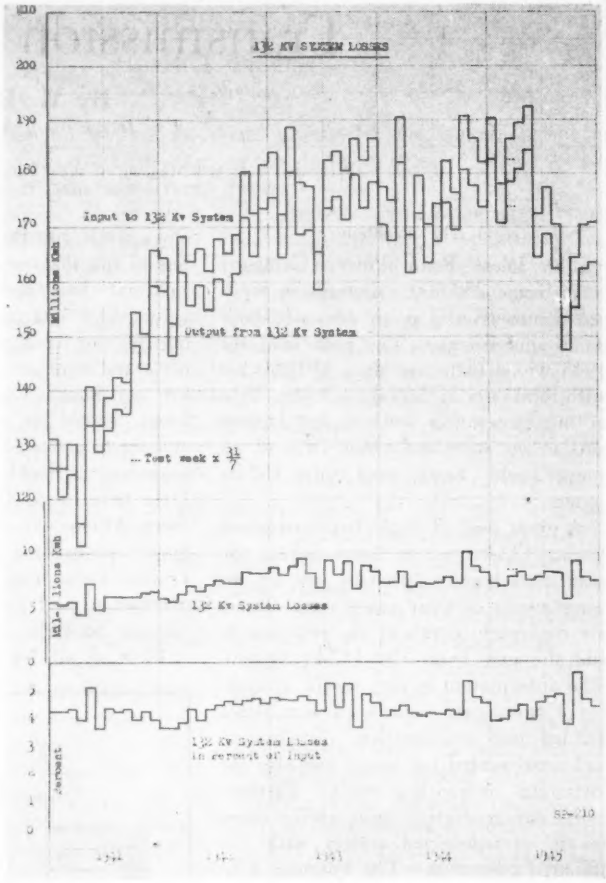

132 KV SYSTEM LOSSES
Input to 132 Kv System
Output from 132 Kv System
...Test week x 31/7
Millions kwh
132 Kv System Losses
132 Kv System Losses in percent of Input
Percent

Chart 3—132-Kv System Losses

covers the past five years from 1941 to the end of 1945. The ordinate represents millions of kilowatt hours. The top curve shows the total generation, purchases, and interchange, giving a monthly peak in March of about 267 million kwhr. The next curve shows the total sales for the same months, which includes the residential, commercial, industrial, street lighting, and sales to other utilities. The next curve is the difference between the two curves and represents the total system losses. Note that this varies from 10 to 31 million kwhr per month. The bottom curve shows the total system losses as a percent of the total output varying from 4.6 to 13.5%.

Chart 2 shows the relationship between the total system losses and the 132-kv system losses. The abscissa is the same as the preceding chart, showing a 5-year period, and the ordinate is again in millions of kilowatt hours. The top curve again shows the total system losses, the next curve gives the corresponding 132-kv system losses, and the lower curve shows the percentage that the 132-kv system bears to the total system losses. This curve varies from 22 to 69% and is always high during the month of February. The reason that February values are so high is because the total system losses for these months are low, brought about by the fact that the input to the system is on a calendar basis, that is the meters are read on the last day of each month whereas the sales, which is the summation of the customers' meters, are taken from the 23rd to the 22nd of the month, except for the large power customers, which are on a calendar month. Therefore, the sales would include for the month of February, thirty or thirty-one days. This is partially compensated for in the month of March.

Chart 3 shows the 132-kv system losses. The abscissa and the ordinate are the same as the preceding charts; the top curve shows the total input to the 132-kv system, the next curve the output, the third curve is the difference, or the 132-kv losses varying from about four to a little over ten million kwhr and the bottom curve shows the 132-kv losses in percent of input. The total input to the system, you will note, is less than the total sales because of the fact that only about 70% of the energy is transmitted over the 132-kv system. The rest of it goes directly into the 25-kv system at generating stations. Note also on this curve the dotted values for March 1945, which represent the values obtained from the test week shown on a monthly basis, that is by being multiplied by $\frac{31}{7}$. This value fits in very closely to the total for that month.

So much for the magnitude of the losses. Now the system itself—

III. System Layout and Metering

Chart 4 shows the 132-kv transmission system. Generation is supplied at Springdale, Windsor, and Lake Lynn. From Springdale the power flows to Butler over a 22.9-mile double circuit line, to Kittanning over a 23.6-mile double circuit line supplying Kiski Val-

Chart 4—132-Kv Transmission System

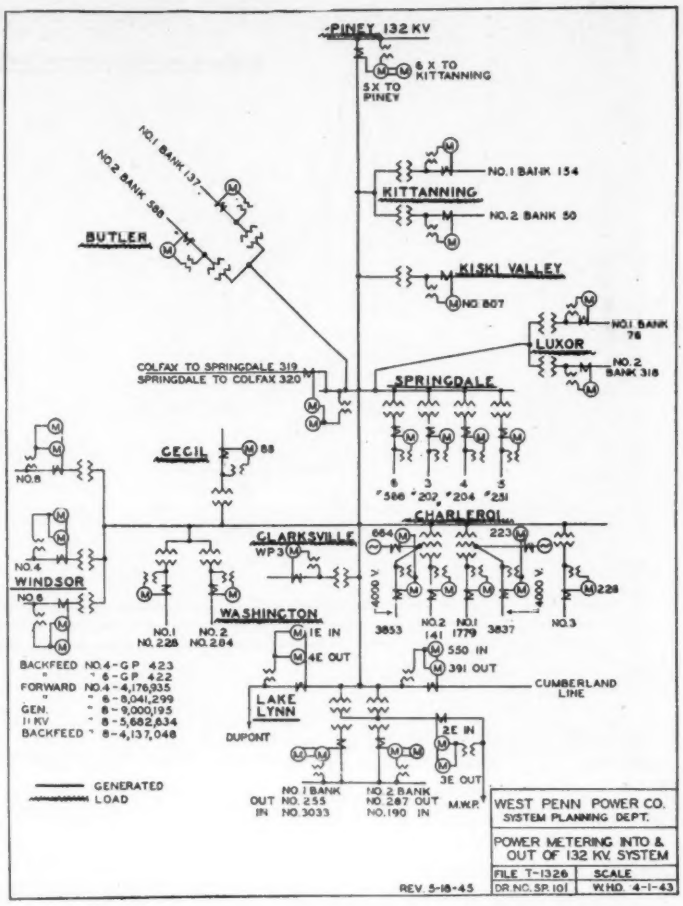


Chart 5—Power Metering Into and Out of 132-Kv System

ley on the way. The line from Kittanning to Piney is 29.0 miles in length and is a single circuit, wood pole line, and at Piney we supply load to our northern section of the territory called our Keystone-Western Division, and also interconnect with the Pennsylvania Electric Company at that point. Power also flows from Springdale to Luxor over a 21-mile double circuit line, and to Charleroi over a 31.3-mile double circuit line. From Windsor the power flows to Charleroi over three lines approximately 42 miles in length, supplying Washington and Cecil on the way.

At Lake Lynn we have a hydro station and power may flow in or out of this station, depending upon the amount of water available. You see there is a 29.2-mile double circuit line between Lake Lynn and Charleroi. At Lake Lynn we also tie to our sister affiliates. Note that the lines are rather short in length from the generating stations, there being about thirteen lines, over which a total of some 280 mw of power flows. Piney to Lake Lynn is about one hundred miles.

The special test week involved the input and output from this system. Ammeters were read each hour on all transmission lines and stepup and stepdown transformers into the system. These hourly readings were assumed in our loss calculations to be constant for the entire hour regardless of whether the load was increasing or decreasing. The metered losses were obtained by taking the difference between the kilowatts per hour readings on the "in" and "out" to the system.

Chart 5 shows the power metering into and out of the 132-kv system. The input is metered at—

1. Windsor on the 11-kv side through three transformers of 126 Mva total capacity.

2. Springdale, also metered on the 11-kv side. Four stepup transformers of 182 Mva capacity. This test was made before our new unit was installed at Springdale.

3. At Lake Lynn, where the load may flow into or out of the 132-kv system, depending upon whether there is generation or whether our sister utilities are supplying us or we are supplying them. The 132-kv bus is completely metered with "in" and "out" meters.

All loads are metered at 25-kv except Piney, which is really an interchange point and is metered at 132 kv.

In addition to the metered values of amperes and kilowatt hours, weather data was taken in an effort to determine if the losses were a function of the weather. *Chart 6* shows the weather for the week of the test. The top portion of the curve represents the temperature. The dot-dash curve is the value obtained at Piney, the northernmost tip of our system. The dash curve is Lake Lynn, the south end. There is a distance of about one hundred miles between the two stations. The center curve shown solid represents the temperature at about the center of our system, or at Springdale. You will note rather warm weather at the beginning of the week, and weather around freezing during the middle of the week. The row of dots in the center of the curve represents the barometer readings at Pittsburgh which were used for corona calculations. The bottom portion of the curve shows the kind of weather—the straight line without any cross hatching represents the clear weather, the x'd portions rain, and

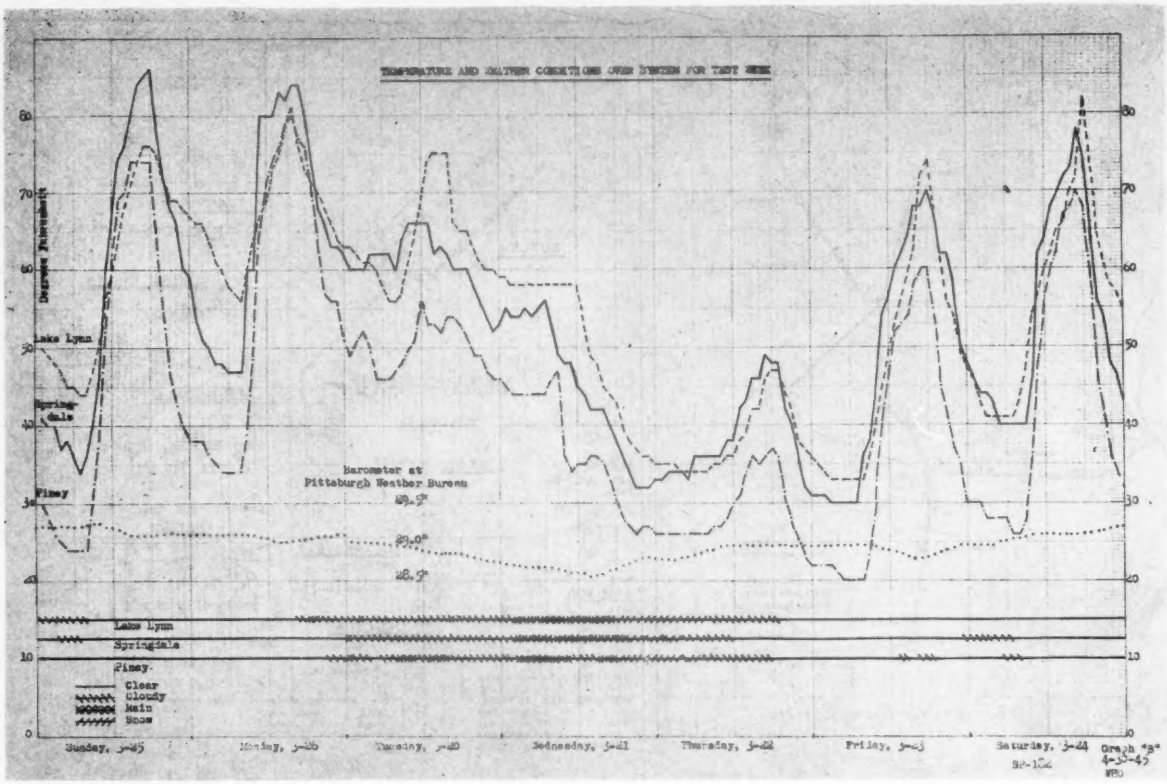


Chart 6—Temperature and Weather Conditions over System for Test Week

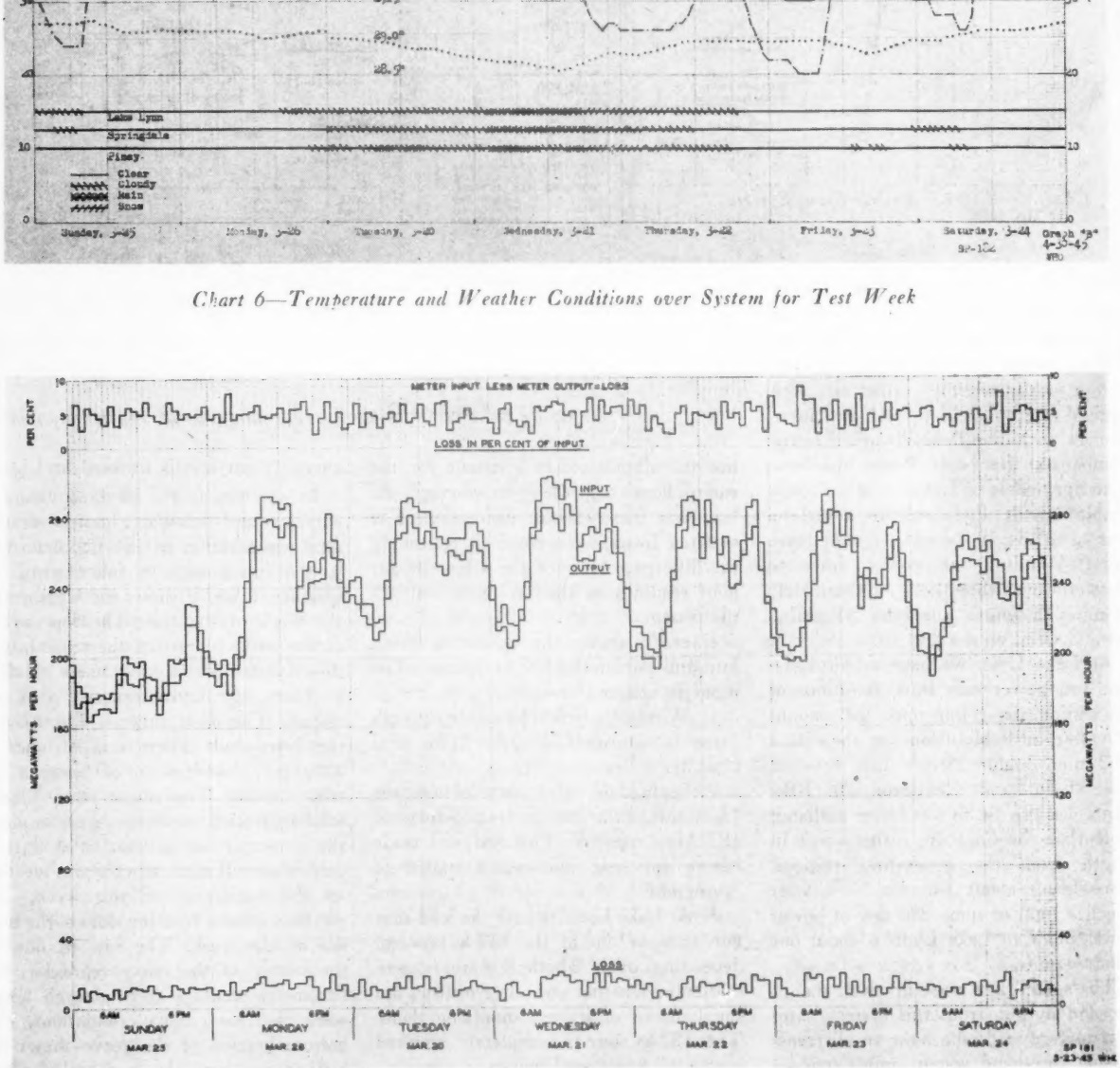


Chart 7—132-Kv System Loss Study—Special Test Week

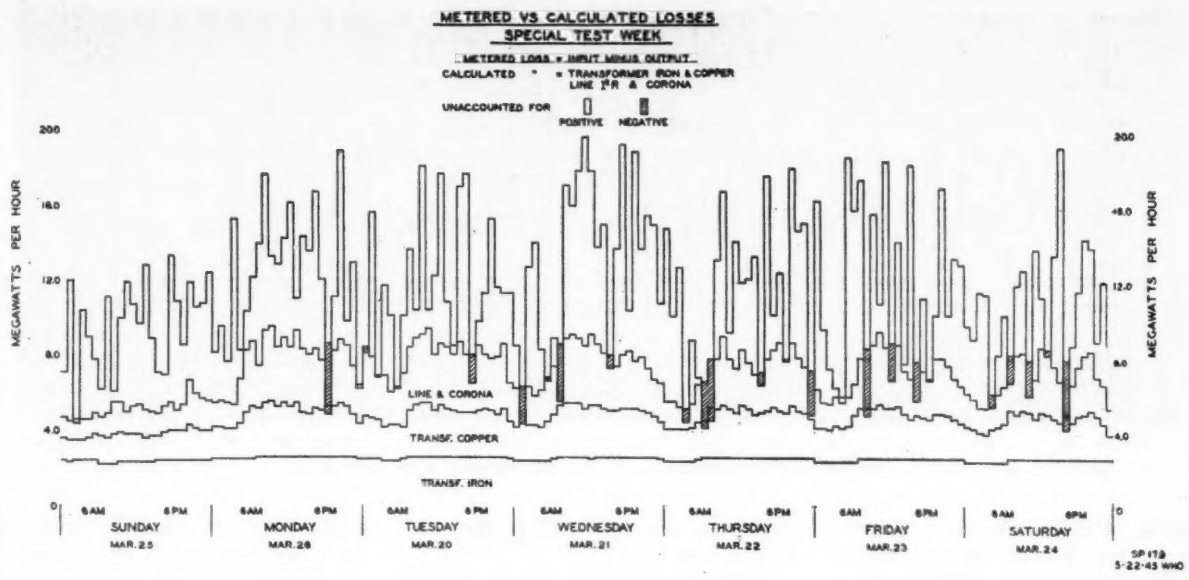


Chart 8—Metered vs. Calculated Losses—Special Test Week

the cross hatching sloped to the right, snow. So you see we had all types of weather during the week, clear warm days at the beginning with rain and snow in the middle of the week and clear weather at the end of the week. If losses are a function of the weather this week was certainly ideal to show this up.

The metered value of our 132-kv system losses as obtained from the special test week is shown in *Chart 7*. The top curve shows the metered loss in per cent of input varying from 2 to 9 per cent. The next two curves show the input and the output from the 132-kv system and the bottom curve shows the metered losses by hours for this week. The ordinate is mw. per hour and shows the peak loss of about 20 mw. The irregularity of this loss curve cannot easily be ironed out by assuming that the meters were incorrectly read. The next slide will show this irregularity in more detail. We realize that it is not possible to have the operators read at exactly the same moment each hour. Some may read before and some after the hour. However, the reading routine followed was such that the sequence of reading would be about the same each hour. The total kilowatt hours for the week was considered fixed and any irregularity in one hour had to be adjusted for in the next hour or hours. Each station was investigated in detail to eliminate any apparent irregularities in reading and the results were correct as far as possible.

So much now for the actual metered losses, now how to account for them.

IV. Calculated Losses

Chart 8 shows the metered losses for the week and the components as far as calculations were able to determine. The bottom section shows transformer iron loss. The values used were given by factory test and totalled 2636 kw peak. Our system might be called one in which the voltage is relatively constant, as the variation was only in the neighborhood of 1.5 per cent overall at any location. Therefore no correction was made for voltage variation as it would have little effect on the total watts iron loss. The next band shows the transformer copper loss. This was determined by taking the ampere readings into the stepup and from stepdown transformers at each location and multiplying them by the resistance given from factory tests. This resistance is given at 75° C. and produced a peak transformer copper loss of 2891 kw. The temperature might be a little high for the loading of the transformers and the actual ambient temperature during the week. However, a change as much as 25 degrees would only change the losses by 234 kw. Therefore these losses might be slightly on the high side.

The next band gives the line and corona losses. Here again the line losses were calculated by using the ammeter readings on the hour and the resistance of the line. Where both sending and receiving end currents were given the sending end current was used. The resistance of the copper was assumed at 25° C. or 77° F., which seemed about right for the ambient temperature during the week. The maximum loss was found to be 3802 kw and here again a 25-degree change would only mean 380 kw. The line losses seem rather small due to the short distances involved and the light loading of the circuits. However, a total of 280 mw divided by thirteen circuits equals 21.5 mw per circuit, or 100 amperes at 132 kv. The loss of 100 ampere current over a 30-mile 4/0 line is about 250 kw, or about 1 per cent. I would like to point out here that our system has a high power factor, measured at the 25-kv bus, running between 91 and 96 per cent, therefore very little reactive loss is involved.

The corona loss was calculated by using Peterson's formulae and gave a peak of about 180 kw. Peterson's formulae gives the corona loss as a function of the relation between the operating voltage and the disruptive voltage, the disruptive voltage being a function of the air density and the conductor size and spacing. Our lines are all 4/0 or 4/0 equivalent with an equivalent spacing of about 17 ft at a normal altitude of 1250 ft. Considerable detail was gone into in the calculations of these corona losses, but frankly, there is not a great deal of information available about corona, particularly for stormy

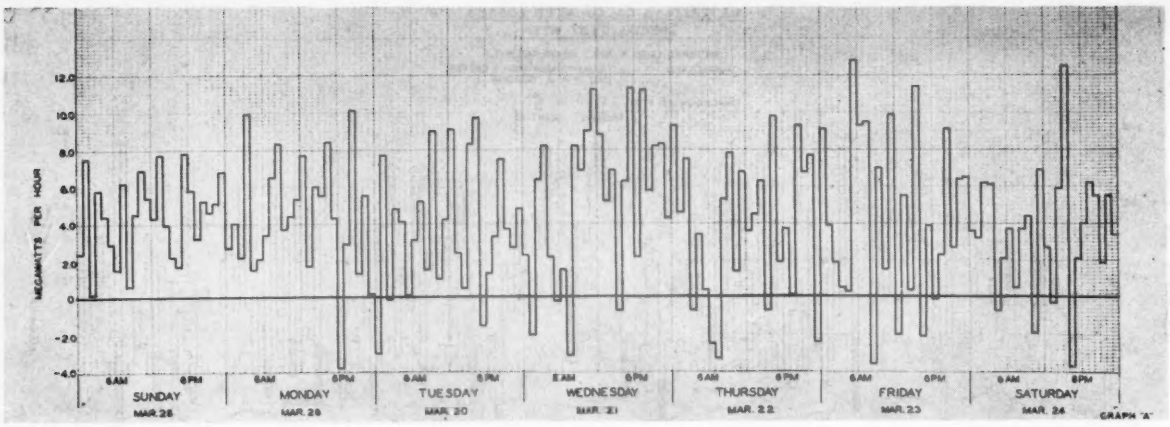


Chart 9—Unaccounted for Losses—Special Test Week

weather. Peterson's formulae gives the loss for fair weather but says nothing whatever about stormy weather. However, if corona losses are high in our system the losses during the days where rain and snow prevailed should be relatively high, which was not found to be the case. We have always felt that we had a very small corona loss and this test confirmed our belief.

Now the total calculated loss falls short of the metered value, the top portion of the curve being the so-called "unaccounted for" losses. The total calculated losses for the week amount to 1211 mwhr or an average of 7.2 mw per hour. The metered values gave a total of 1921 mwhr or a total of 11.4 mw per hour, leaving a total of 710 mwhr for the week, or an average of 4.2 mw per hour. Now what about the area above the top line of this curve, shown by itself on the next chart.

Chart 9 shows unaccounted for losses during the special test week. These unaccounted for losses include—

1. Meter accuracy. The first item to suspect on a test of this kind is the meter accuracy. All integrating meters involved in this test were tested by our meter laboratory during the past year. The average accuracy of all the "in" meters (14 in number) equalled 99.93 per cent. The average of all the "out" meters (25 in number) was 100.13 per cent. If both the "in" and "out" meters were 100 per cent correct the metered losses would be increased rather than decreased. Furthermore the peak power flowing from any one of the "out" meters was about 25 mw. The greatest load on the "in" meters at Windsor was 61 mw and at Springdale 40, so an error in any one meter would not affect the total a great deal.

2. The second item would be the losses in the potential and current transformers, potential devices, and coupling capacitors, but these are given as a matter of watts and the total for the entire 132-kv system would be very small. The same applies to bushing losses and lightning arrester losses. The total for all of these would certainly not be more than 50 kw per hour.

3. Insulator leakage was first thought to be of considerable magnitude, but tests were made at the Ohio Brass high voltage laboratory at Barberton, Ohio, on several strings of extremely dirty insulators, with the result that the loss was found to be less than 10 watts per string, and for 11,000 strings, 110 kw.

4. Other losses considered were:

a. Cable loss. There is some cable loss involved between the metering points and the stepup transformers, but checks on these losses show them to be extremely small.

b. Circulating power and reactive. This was not considered very high, and since the calculated losses are determined from ammeter readings, some of this circulating power would have to pass through the meters.

c. Harmonic currents also not considered high because of fairly good wave shape.

d. The most obvious place to look for these unaccounted for losses would be a load not metered at the substation, but the substation department have examined these connections and have found that all power was metered.

e. As far as theft is concerned our line walkers have not indicated that any one was making temporary connection to our 132-kv system without our knowledge. We have no 132-kv customers.

V. Summary

This study, as I have said before, shows a discrepancy of 37 per cent, but by adding pessimistic values for all discrepancies, that is allowing a 3 per cent increase in transformer core loss, an 8 per cent increase in copper loss, a 10 per cent increase in line I^2R, doubling the corona loss and adding a bushing loss of 50 kw per hour and an insulator leakage of 120 kw, the total unaccounted for still remains 3400 kw per hour, or 30 per cent. We are unable to explain this discrepancy and we would like to know—

1. If you have made similar tests and have been able to account for all of your losses?

2. Where you might suggest we could look for our unaccounted for losses?

3. If you have not made similar tests, maybe you would be willing to undertake some similar detailed study.

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What Safety Begets

By Thomas W. Trice

Assistant General Superintendent Electric Operations, Consolidated Gas Electric Light and Power Company of Baltimore

A condensed version of a paper presented at the Fall Meeting of the Edison Electric Institute Accident Prevention Committee

A LIGHT and power company is judged by the kind of service it renders. Now, as a term, service is a rather expansive expression. It encompasses a wide variety of conditions, circumstances, performances and responsibilities. Any light and power company that enjoys the reputation of giving good service qualifies through efficient and intelligent fulfillment of its duties to the public.

Assuredly, the end point of good service is continuous power at the switch. But electricity just doesn't get to the switch of its own volition. It has to be sent there; furthermore, there are many factors that control the constant availability of service. Some men have summarized these factors under the single phrase, efficient operation. Suppose we briefly analyze efficient operation.

In the regular performance of their duties, operating men are charged with the proper appraisal of various processes and procedures. They weigh and evaluate the results that can be expected to follow the development and procurement of additional equipment to increase overall efficiency. They decide what the new installations will bring forth in the way of improvement. Their findings must be tangible and measurable. If the results do not substantiate their initial estimate, concentrated study is brought to bear; reasons and explanations are produced. They determine why what was expected did not materialize and then set about correcting matters so that they will accomplish what they planned. When they succeed in arriving at the correct solutions, increased efficiency follows. And, it might be added that operating men, human-like, derive no small degree of self-satisfaction from solving their problems.

Now what has this to do with safety? Simply that safety is one of those many factors embodied in that all inclusive term, efficient operation. Any undertaking, no matter how small or how large, that is troubled with a high accident rate cannot be efficient for it is wasteful of property, wasteful of time, and, most serious of all, it is wasteful of life itself.

Thus, the problem of accidents is of genuine concern to the progressive power company executive. Yet, with all the attention that is given to this problem, we are not currently making startling progress in reducing accidents in our industry. We can scarcely point with pride to a severity rate of slightly less than 2.0 days lost per 1000 man-hours worked, or to a frequency rate of slightly below 12.0 disabling accidents per 1,000,000 man-hours worked. On the contrary, we are forced to admit that these accidents rates are very high. Furthermore, we must recognize the fact that even with the best efforts of the Edison Electric Institute Accident Prevention Committee, safety engineers and other interested parties, the accident experience rate has been more or less static for quite a few years. The curve has hit a plateau. This is a challenging situation. Why isn't the accident rate knocked down off this plateau? It is my opinion that operating supervisors of the power and light industry should view this situation as a personal challenge for they can derive much benefit through the elimination of accidents. Accidents can wreck any project. Even a single mishap can throw the proverbial monkey-wrench into the main workings and forestall the success of an entire undertaking.

What Constitutes Safety?

To an operating supervisor safety signifies obtaining results without accident to personnel or damage to equipment. To him an accident is an interference. It is not an ordinary interference because in many instances in addition to affecting operations directly, the mishap has a personal element in it. Someone sustains personal injury. No employee in any capacity, and Management is included, of course, can witness or review the facts of an accident that results in human pain and suffering without experiencing a reaction. This reaction may not be apparent for some men bury their sympathy beneath a thick crust of "toughness," but in many cases they are the very ones who go through the greatest emotional strain. Thus accidents qualify not only as interferences to operations, but also turn out to be disturbances to people other than the injured.

Now the purpose of a safety program is the prevention of accidents, and should be considered an integral part of a power and light company's operations. But the prevention of accidents carries with it even more than the elimination of interferences to service and personnel. It carries also a freedom from worry and anxiety, as well as the assurance that operations will proceed smoothly and efficiently without those sudden shocks that tend to disorganize and dishearten us all. An operating supervisor therefore has a personal stake in the success of a safety program.

Causes and Effects

What causes accidents? Each of us could easily list quite a few things which, in our opinion, are the causes of accidents. What is the effect of accidents? To this question also, each of us could find many answers, depending, of course, upon our individual relationship with a particular accident. For example, the effect of an accident upon the man who sustained an injury is one thing, upon his partner on the job, it is another, and upon supervision, perhaps yet another. But the fact remains that an effect is there and felt by all.

EDITOR'S NOTE: At this point Mr. Trice reviewed the actual facts of several occurrences within his personal experience. The causes and effects were set forth in detailed manner. The accidents were discussed under the five headings:

I. *Divided Responsibility.*
II. *What Price Poor Housekeeping?*
III. *Inadequate Planning.*
IV. *Lack of Understanding.*
V. *Short Cuts.*

Conclusion

Upon review of accident cases it becomes readily apparent that accidents beget wasteful loss. Valuable work time is lost. In many cases property is destroyed. Operations and work procedures may be subjected to serious and costly interruptions. Overall efficiency can be

greatly reduced. All these things are of great concern, but they can be compensated for in some measure. But there are other factors much more serious in the aftermath of accidents, and for which compensation is inadequate, if not impossible. Supervisors and other employees are affected emotionally as a consequence of an accident to a fellow employee, and there is no compensation commensurate for the loss that follows the destruction of an individual and the utter waste of human resources. No instance has been cited herein where the accident proved to be fatal. We have all gone through the terrible experience of having a fellow employee fatally injured, however, and the effect upon us was severe indeed. Our fellow employee was destroyed and we were filled with remorse at the suffering and sorrow that befell the man's family.

The aftermath of accidents, therefore, can be a pyramiding of challenging unwanted consequences. Such challenges must be met in operations and correct solutions found. Begetting as they do, waste and loss, accidents are not compatible with efficient operations.

If we accept the foregoing as the penalties from accidents, does it not follow that the prevention of accidents carries with it rewards and benefits? Is it not true that safe workers lead a happier and more successful life? Then, again, the operating supervisor who has an effective safety program functioning smoothly escapes those emotional upsets that arise from accidents. His operations run along more efficiently. His personnel problems are less complicated. He can plan ahead. He can engineer for safety. He can get more accomplished. Greater satisfaction and happiness are his lot.

Finally, mention should be made of the relation between operating supervision and the safety engineer. The operating supervisor is responsible for maintaining production and safety at a high level. As head of the line organization he recognizes the importance of the safety engineer whose duties are of a staff nature. There is no need for cutting across the respective fields of activity. Success in accident prevention calls for cordial relations and a pooling of efforts toward the elimination of accidents.

The operating supervisor knows that a safety program, like a pump, must be primed. He should appreciate the fact that it is the safety engineer's job to

(*Continued on page* 93)

Cost of Living at a New High; Cost of Electric Service at a New Low

Although the cost of living is still going up, and the prices of food and clothing are half again as much as they were in August, 1939, the cost of electric service in the home has reached a new low point as the only item in the household budget which is cheaper now than it was before the war.

While the price of electricity has been stabilized, the cost of coal keeps rising. In December, 1945, states the U. S. Department of Labor, anthracite prices were the highest since the first quarter of 1926, while those of bituminous coal were at the highest levels since 1923.

The following table shows how the index of group "fuel, electricity and ice" has risen from 97.5 per cent of the 1935-39 average at the beginning of the European war in August, 1939, to 110.3 in December of last year. All of this has been due to changes in the cost of coal; the classification "Other fuels and ice" having risen from 96.3 per cent to 126.1 —or by more than 30 per cent of its pre-war cost—while the classification "gas and electricity" has actually declined from 99 in August of 1939 to 94 last December.

COST OF LIVING* IN LARGE CITIES - NOW AND PRE-WAR
Index Numbers (1935-39 = 100)

Date	All Items	"Fuel, Electricity & Ice"	Gas and Elec	Other Fuels & Ice
Aug 1939 (Month before War)	98.6	97.5	99.0	96.3
Jan 1941 ("Little Steel" Decision)	100.8	100.8	97.5	104.0
May 1942 (General Price Control)	116.0	104.9	96.6	112.9
May 1943 ("Hold the Line" Order)	125.1	107.6	96.1	118.7
Dec 1944	127.0	109.4	94.8	123.6
Dec 1945	129.9	110.3	94.0	126.1

Individual groups in December, 1945, compare with August, 1939 as follows:

Group	Dec 1945	Aug 1939	Change in %
	—Index Numbers—		
All Items	129.9	98.6	+31.7
Food	141.4	93.5	+51.2
Clothing	149.4	100.3	+49.0
Rent	108.3	104.3	+ 3.8
Fuel, Electricity & Ice	110.3	97.5	+13.1
Gas & Electricity	94.0	99.0	- 5.1
Other Fuels & Ice	126.1	96.3	+30.9
House Furnishings	148.3	100.6	+47.4
Miscellaneous	124.8	100.4	+24.3

*Note: * Now entitled "Consumers' Price Index for Moderate-Income Families."*
Source: "Cost of Living and Retail Prices" Monthly Labor Review. (U. S. Department of Labor)

Walter Wagner Gets Commendation from Navy

Captain Walter C. Wagner, U. S. N. R., of the Philadelphia Electric Company, who was recently released from active duty with the U. S. Navy, has been commended for his service during the war by the Secretary of the Navy.

The citation from Secretary Forrestal follows:

"For meritorious performance of duty while serving in the Bureau of Ships as Head of the Research Group and later of the Electricity Section, Research and Standards Branch, from June, 1941, to September, 1945. Efficiently carrying on the work of his section despite the shortage of material and manpower, Captain Wagner contributed to the development of the gas turbine drive and the related electronic linkage and aided in establishing a priority system for laboratory projects. Serving on various councils and committees, he did outstanding work resulting in the wartime standardization of electrical subjects and in proposed post-war projects of vital importance, including a move toward the legalization of a basic measure of length and a simple relationship between the English and the metric systems. His zealous and far-sighted leadership aided in the prosecution of the war, reflecting highest credit upon Captain Wagner and the United States Naval Service."

Germany to Be Stripped of Major Part of Electrical Industry

Committee Recommends Removal of Two-thirds of Power Facilities; Will Cripple Reich's Ability to Make War

By John H. Ronayne
Edison Electric Institute

EDITORS NOTE:
The following article discusses the preliminary report to the Foreign Economic Administration by the Technical Industrial Disarmament Committee for the German Electric Power Industry.

Acting on declarations of policy on disarming Germany established at Yalta, and additional instructions from the late President, FEA formed TIDC's for major German industries. Their reports are expected to be used in formulating a United States program covering the whole field of German economic and industrial disarmament.

Edward Falck, Director, Office of War Utilities, WPB, was the Committee Chairman. The Committee consists of utility executives, government power officials, and representatives of FEA, WPB and the U. S. Army and Navy. The report, printed last July, has been restricted in circulation until recently.

IMMEDIATE reduction of Germany's electric power capacity to the minimum required for a peacetime economy, and administrative control of the Reich's power stations and manufacturing plants with the objective of preventing expansion of generating capacity for an undefined period, are recommended by the Technical Industrial Disarmament Committee for the German Electric Power Industry in its report to the Foreign Economic Administration.

Prepared to help formulate a proposed program to disarm Germany industrially, in order to forestall any incipient Fuehrer from quickly resurrecting the Wehrmacht for revenge and Attempt No. 3 at world domination, the report lists five major recommendations:

1. Immediate reduction of Germany's power capacity to a figure tentatively estimated at 9,000,000 kilowatts (entails a program to dismantle and remove from Germany at least 13 million kilowatts of generating capacity and transmission facilities.)

2. Export of electric energy from Germany as reparations to be strictly limited to a temporary period. All possible measures to be taken to prevent export of German power from becoming a permanent practice.

3. Administrative control of the power industry for an undetermined period, to prevent expansion of generating and transmission capacity above the peacetime figure.

4. Establishment of an administrative organization headed by a Utilities Director, responsible to the Allied Control Council, with authority to effect removal of the 13 million kilowatts of capacity, and to supervise operation of the utility and manufacturing industries.

5. Inclusion in the peace treaty of a clause prohibiting expansion of Germany's electric industry above the level required for her peacetime economy, the level to be periodically reviewed by the appropriate international enforcement agency.

Basic Plan for Removal

The Committee's studies indicate that in 1944 Germany had approximately 22 million kilowatts of electric generating capacity, as compared with her known capacity of 12.9 million kilowatts in 1932. Essential power requirements for the assumed peaceful economy can be met by not more than 9 million kilowatts of capacity within the Reich's borders.

In order to bring the German capacity to this level, it will be necessary to remove about 60 per cent of the existing generating and associated transmission capacity. The dismantling and removal of these facilities will require the work of a labor force of about 10,000 men for three years, or 30,000 for one year.

Reasons for Removal

Major industries essential to war economy require large amounts of electric power in almost every case, the Committee states, adding that this is particularly true with the important electro-chemical and electro-metallurgical industries. Not only is availability of electric power a limiting factor in the operations of these industries; while their productive facilities can be substantially expanded in from 6 to 12 months, expansion of the power producing equipment upon which they depend usually takes much longer. Limitations on electric generating and transmission facilities would, therefore, place a most effective brake on future expansion of German heavy industry.

Study of specific major industries contributing to the German war potential proves them to be heavy consumers of electric power. Of the 65 billion kwh required by German industry in 1944—which, incidentally, is nearly 87 per cent of the estimated total consumption for that year—the synthetic oil industry used 13 billion kwh; calcium carbide, 7.9 billion kwh; iron, steel and ferro alloys, 7.2 billion kwh; machinery, 6 billion kwh, and aluminum and magnesium, 5.6 billion kwh.

Together these vital war industries accounted for nearly 40 of the 65 billion kwh consumed by all German industries in 1944. If the anticipated disarmament program drastically reduces all these industries, a large block of surplus power capacity will be created; and the elimination of this excess capacity, in turn, will multiply the difficulties of future revival of war industries.

The natural temptation to export this surplus power to neighboring countries should be resisted, the Committee states, asserting that this would only strengthen German economic dominance over her neighbors, allow her to transfer power on short notice to her own heavy industry, and encourage a high-gear maintenance of the electric equipment industry — one which is among the most versatile and valuable manufacturers of munitions, and a field in which Germany has been the world's leading exporter.

Current Status of the Power Industry

Examining the Reich's electric power industry from the latest available data, the Committee estimates that generating capacity totaling 12.9 million kilowatts in 1932 had been expanded to about 22 million kilowatts in 1944. The probable supply of electric power in 1944 was about 90 billion kwh, as compared with less than 24 billion kwh in 1932. Of the 1944 consumption, over 87 per cent or 65 billion kwh was used for industrial purposes.

GRAPHIC ANALYSIS OF THE GERMAN ELECTRIC POWER INDUSTRY

The following table summarizes for the period 1927-37 the capacity and energy supply in Germany, along with an estimate for 1944 by the British Ministry of Economic Warfare:

Year	Capacity	Output	Exports	Imports	Total energy supply
	Mw.	*Million kw.-hrs.*	*Million kw.-hrs.*	*Million kw.-hrs.*	*Million kw.-hrs.*
1927	10, 242	25, 134	175	265	25, 224
1928	11, 101	27, 870	181	293	27, 982
1929	12, 416	30, 660	178	398	30, 880
1930	13, 168	28, 914	136	605	29, 383
1931	13, 049	25, 788	133	674	26, 329
1932	12, 880	23, 460	134	578	23, 904
1933	12, 915	25, 654	84	603	56, 173
1934	13, 326	30, 662	90	830	31, 402
1935 [1]	14, 252	36, 710	97	1, 100	37, 713
1936 [1]	15, 163	42, 487	91	1, 210	43, 606
1937 [1]	15, 918	48, 969	102	1, 231	50, 098
1944 [1] (est.)	23, 000	86, 000	------	1, 600	87, 600

[1] Data for 1935 and subsequent years includes Saarland.

Over 9 million kilowatts of Germany's capacity is owned and operated by industrial plants. Total hydro-electric power capacity probably does not exceed 2.1 million kilowatts.

Germany's steam electric generating capacity is divided into two main classes, by type of fuel required. About 60 per cent of the large steam stations use hard coal, and the remainder are designed for lignite. The fact that hard coal is urgently needed for fuel throughout Europe, and is largely imported from Germany, has an important bearing on the Committee's recommendations for removal of power plant capacity.

By 1944 all major generating plants, utility and industrial, had been interconnected. There were also important interconnections with large hydro stations in Austria and Switzerland, and interconnections with France, Poland, Czechoslovakia, Denmark and the Low Countries.

An interesting point in regard to interconnections is that, while Germany's neighbors have consistently depended upon her for industrial items, particularly heavy power equipment, the Reich in turn has usually imported power. Even in 1937, net imports amounted to more than one billion kwh, and throughout the war, Germany remained a net importer of power. The 1944 net import figure possibly reached a high of 4 billion kwh.

As to the damage inflicted upon German power facilities by the war, the preliminary reports to the Committee by staff members indicate that most of the equipment is in operating condition, or can be readily repaired.

Dismantling the Power Industry

The Committee's first recommendation, that all generating capacity and associated transmission capacity in excess of 9 million kilowatts be removed from Germany, employs a tentative figure only, since it rests upon indefinite levels of operation to be permitted other industries. Provision for readjustment is made by the Committee.

A significant portion of the facilities to be dismantled can be relocated in other countries as reparations; that portion which cannot be relocated will be salvaged or scrapped, with buildings and foundations completely destroyed.

Insofar as possible, Germany will be left with only her hydro plants and those steam plants burning lignite, so as to free hard coal to serve as fuel for Europe. As much as possible of generating capacity owned by war industries will be destroyed. Where a choice exists between elimination of several small stations and one large plant, the small units will be removed, since one large plant is more vulnerable to air attack.

Power Exports to be Only Temporary

Export of power from Germany—now necessary because of fuel and transportation shortages in other countries, should be limited, and arrangements made to curtail export of power as early as possible. The dangers inherent in Germany becoming a major power source for Western Europe over the next decade have been previously discussed.

Continuing studies with a view to determining the extent to which it may be sound to increase German imports of power, and so allow still further reductions of generating capacity, are recommended by the Committee. A proposal to make the Reich entirely dependent upon imports of power—depriving her of all generating capacity within her own borders—is considered impractical by the Committee. It is recognized, however, that as long as Germany has a sizable amount of capacity, it will be possible to increase power supply for industrial operations, by stringent rationing, increasing factory hours of operation and other emergency devices.

Responsibilities of Utilities Director

Strict surveillance of German industry and power plants to prevent unauthorized additions to generating capacity is the Committee's third recommendation. Control of imports of heavy electrical equipment, control of manufacture of such items, and strict regulation to prevent additions under the guise of repair or replacement will all be required, and will be the responsiblity of the Utilities Director.

His early appointment and immediate action on the dismantling and removal of surplus capacity is strongly urged by the Committee, which points out the present demand among European countries for equipment of the type to be made available by the removal program. Salvaged equipment can be put to work much more quickly than that newly manufactured.

The proposals of the Committee are intended to be applied to the entire German economy, and not merely the American occupation zone. The intent of the disarmament program could be defeated unless applied to the country as a whole, the Committee points out, adding that the entire job of creating the policy and supervising its execution should be under the direction of a single head.

The suggested use of the electric power industry to control other industries for disarmament purposes, through reports on energy use by specific plants and by cutting off deliveries to plants failing to abide by restrictive regulations, is difficult and unreliable, the Committee states. Meter-tampering and jumping make such reports fail to reveal true conditions. Direct police measures, enforced by the military governments, would be necessary to make sure that a plant does not receive power after an official cut-off.

Administrative Problems in Removal Program

The Committee's removal program urges an analysis of Germany's power

Consumption of Electricity in Germany in 1944, as Estimated by Foreign Office and Ministry of Economic Warfare, Economic Advisory Branch [1]

Types of consumption	Annual consumption (billions kw.-hr.)	Percent of total
Industry:		
Synthetic oil	13.0	17.4
Calcium carbide and derivatives	7.9	10.5
Aluminum	5.0	6.7
Synthetic rubber	2.2	2.9
Ferro-alloys	2.0	2.7
Synthetic ammonia	1.4	1.9
Chlorine and caustic alkalis	1.1	1.5
Magnesium	.6	.8
Other electro-chemical and electro-metallurgical	1.0	1.3
Hard coal mining	4.6	6.1
Brown coal mining and briquettes	2.8	3.7
Other mining	.6	.8
Engineering	6.0	8.0
Iron and steel	5.2	6.9
Coke	1.1	1.5
Textiles	2.0	2.7
Pulp, paper and cardboard	2.3	3.1
Building materials	1.0	1.3
Foodstuffs	1.0	1.3
Other	4.2	5.6
Subtotal for industry	65.0	86.7
Domestic and small businesses	6.0	8.0
Traction	3.0	4.0
Agriculture	1.0	1.3
Total consumption	75.0	100.0

[1] Germany, Electricity Supply; Part 2: Distribution and Utilization.

Estimate of Minimum Post-War Requirements

Energy, billion kilowatt-hours

	Basis A [1]	Basis B [2]
Consumption by:		
Domestic and small businesses	5.0	5.0
Agriculture	1.0	1.0
Essential utility services, incl. street railways, public lighting, water supply sewage, disposal, etc	1.5	1.5
Electrified railroads	1.0	1.0
Industry	15.0	20.0
Total consumption	23.5	28.5
System losses	4.7	5.1
Required energy supply	28.2	33.6
Net imports	1.5	1.6
Generation requirements	26.7	32.0
Capacity, million kilowatt-hours		
Peak load on systems	7.42	8.15
Allowance for imports and reserve requirements	1.00	1.10
Total capacity requirements	8.42	9.25

[1] Industrial consumption 15 billion kw.-hrs.
[2] Industrial consumption 20 billion kw.-hrs.

facilities, and a series of decisions leading to selection of certain plants for dismantling, which will still leave a power system adequate to estimated peace-time needs. Removal of any one station involves study of an elaborate transmission network, and interconnected generating stations. Removal of a station serving a defined area will frequently mean that reliance must be placed on a power source farther away, necessitating new transmission facilities or re-arrangement of existing facilities.

One difficult decision will be as to which of the facilities damaged by bombing will be repaired for use, and which will be repaired for reparations, or junked.

The dismantling operation should be conducted in such a way that the greatest possible quantity of reusable equipment will be salvaged. The dismantling of 13 million kilowatts—equivalent to the total power capacity of Great Britain—is estimated to require 70 million man-hours, a three-year job for 10,000 men.

Analyzing the feasibility of relocating major items of power equipment, the Committee believes that turbine-generators, steam condensers, pumps, switchgear, oil circuit breakers and auxiliary equipment could be relocated with comparatively little difficulty, since the electric characteristics of German utilities are generally standard on the Continent of Europe. Hydro-electric plants will not be used as reparations, if the Committee's recommendations are followed, since the continued use of this capacity inside Germany will free considerable hardcoal for export, and it is usually not possible to duplicate the operating conditions of hydro-equipment sufficiently well to make relocation practicable.

Equipment selected for removal will be available to those nations entitled to reparations only after it has been dismantled, sorted, catalogued, and the catalogues studied by the respective nations. Still later, the equipment must be packed and shipped. A sufficient organization to handle these numerous details, and also to assure thorough, irreparable junking of any material not disposed of as reparations, must be set up.

The Control of Power

After completion of the removal program, pressure will exist within Germany for new plants on various grounds. Each request will involve a decision as to whether existing capacity can take care of approved new loads, whether new interconnections will solve the problem, or possibly new imports of power. The power administration should be prepared to make these decisions, and also to see that they are executed.

Preserving the approved level of power supply will involve a tight control of the flow of new electric equipment. In this connection, the very existence of the powerful German electrical manufacturing industry is a great pressure for increasing the size and efficiency of the power industry. If maintenance of a ceiling on power is to be effective, the manufacturing industry must be either rigidly controlled or eliminated, and imports of power equipment controlled. Existing inventories of equipment must also be controlled to prevent their surreptitious return to plants.

Regulations such as those devised by the United States War Production Board could be employed to limit the power industry to an approved capacity

(*Continued on page* 93)

Experience with Emergency FM Radio Communication

By J. P. Woodward and W. R. McMillan

Distribution Service Engineer, and System Superintendent, Distribution Service, Union Electric Company of Missouri

Presented before a meeting of the Transmission and Distribution Committee, EEI, Cincinnati, Ohio, Feb. 18, 1946

ON February 26, 1945, an expanded 2-way FM emergency radio system was placed in service. Assigned call letters are KUEC. Fifty-two additional emergency service cars and trucks, which operate in the greater St. Louis area, were equipped with two-way radio. A 250 watt central station transmitter operated remotely from three dispatching centers controls the communication system. All transmitters and receivers operate on an assigned center frequency of 39.66 megacycles.

The output of the 250 watt central transmitter is delivered into a 70 ohm concentric transmission line of ⅞ in. soft copper coaxial cable which in turn feeds a ½-wave coaxial antenna mounted atop a 200 ft. water tower. Location of the station is central with respect to the area served. This point is in the southwestern part of the City of St. Louis on a hill, at about the highest elevation in the city, which is 193 ft. above the zero City Directrix benchmark located on the Mississippi river wharf. This antenna location provides both an excellent transmitting and receiving arrangement, so that additional pick-up receivers for talk-back from the mobile units are unnecessary.

Mobile transmitters are rated 30 watts output and deliver radio frequency energy to a ¼-wave solid spring steel rod mounted on a double helical spring base. The central transmitter and mobile transmitters are crystal controlled and are designed to maintain center frequency to within plus or minus 0.01 per cent of the F.C.C. assigned value. Transmitters are provided with the Armstrong phase-type of modulation capable of an instantaneous deviation of plus or minus 15 kilocycles when modulated at any frequency from 500 to 3000 cycles. Improved signal-to-noise ratio in the receivers is provided by planned pre-emphasis of high audio frequencies in the transmitters.

The equipment is designed for simplicity in servicing and adjusting. Stable work bench supports are provided and all parts are easily accessible for inspection and repairs. Every socket and control is identified, and multiple test jacks are provided for direct meter readings in the tuned circuits. Radio frequency transformers are of the simplified iron core permeability tuned type which give broad easy tuning and stay in alignment. High voltage supply for the mobile transmitters and receivers consists of separate dynamotors mounted on the individual chassis.

All radio cars and trucks had the standard batteries and generators removed and replaced with 40 ampere heavy duty generators and associated voltage regulators, and 170 ampere-hour heavy duty 6 volt batteries. Reinforcement of the automotive electrical system was deemed necessary, since during trouble work at night the battery is heavily loaded with headlights, spotlights, warning lights, and heater in addition to the emergency radio equipment.

Current consumption of the 2-way radio equipment is as follows:

9 amperes for transmitter and receiver (standby)
36 amperes for transmitter and receiver (transmitting)

Generally satisfactory two-way communication is realized between the central station and mobile units for a distance of 25 to 30 miles. Car-to-car communication, for which there is only occasional use, however, is limited to from about 2 to 20 miles and depends for its effective range upon the character of the intervening terrain.

Prior to the installation of the new equipment the company had in service for three years a pilot radio system which consisted of two mobile units and a mobile set operated as a fixed station. The success of this small system in the speeding up of emergency work led to the installation of the expanded emergency communication facilities now in service.

The tabulation below gives the number of each type of vehicle equipped with emergency radio, the total being 55 (52 additional and 3 from the initial installation):

The location of the radio equipment in the vehicles varies. In the coupes the majority of the installations were made in the turtle shell rear compartment on the street side, and in several of the coupes the radios were installed behind the driver's seat. Radio installation in the one coach was in the rear trunk. Radios in the sedan deliveries were installed on the deck behind the seats with the exception of 4 new cars in which a special compartment was provided. In the ½ ton panel body trucks the installation is behind the seats on the deck. In each of the heavy trucks we were fortunate in having compartments which were easily converted to house the radios.

During the first nine months of operation of the emergency radio system 11,000 two-way messages were completed. This is an average of about 1200 messages per month. The peak

	Coupe	Coach	Sedan Delivery	½ Ton Panel	Special Truck Body	Totals
Line trouble cars	14	..	12	4	1	31
Line construction trucks	..	..	..	..	5	5
Cable fault location car	..	..	1	..	..	1
Trouble supervisor cars	4	..	..	..	..	4
Construction supervisor cars	8	..	..	..	..	8
Substation supervisor cars	2	1	..	..	..	3
Substation inspector-operator cars	2	..	..	..	..	2
Radio maintenance car	..	..	1	..	..	1
	30	1	14	4	6	55

month thus far occurred in June, 1945, during which 2000 messages were completed. Considerable line trouble in June due to wind, rain, and lightning storms accounted for the heavier traffic. There were in addition, 1900 uncompleted messages for the nine months' period. These uncompleted messages were due for the most part to the men being away from their cars when called.

Test and maintenance of the radio system requires 85 per cent to 90 per cent of the time of two men who hold Second Class Radiotelephone Operator Licenses. These two men are under the supervision of a Distribution Service Engineer. All cars are scheduled monthly for equipment tests including frequency measurement and alignment check of the mobile transmitters and inspection of the equipment. Receivers have thus far required little attention. Once every 6 to 8 months the receiver dynamotors are inspected and greased.

Complete test and maintenance facilities have been provided at the central transmitter consisting of a transmitter room with work bench and test instruments and an adjoining garage for work on the mobile units. The majority of the maintenance work is done here. We are at present doing some of this work at the locations where the radio equipped vehicles are garaged by using a portable frequency monitor. This is being done at several of the more remotely located garages because of the difficulty of getting the cars to the central station.

Equipment trouble during the first *10* months of operation is tabulated below:

55 microphone cable shields broken loose at Amphenol plug connector
26 on-off switches burned open in control head
18 control fuses blown due to poor contact in fuse holder
15 antenna cable "Jones" plug connector shields broken loose
14 flexible steel antenna rods broken
34 miscellaneous accessories defects
23 cases of defects in mobile transmitter and receiver chassis
35 tubes replaced in mobile transmitters
32 tubes replaced in mobile receivers
12 tubes replaced in central transmitter and remote control units.

264 total

Our experience with heavy line construction truck radio installations, of which we have five, has been that there is a problem of keeping the batteries charged. This is true even though the trucks are equipped with heavy duty batteries and generators, since they in general accumulate such small daily mileage. The other main trouble with the truck installations has been with broken antenna rods because of the height at which the antennas were necessarily mounted so that they would be in the clear. On three trucks the antennas were mounted on the cab roof, thus making the top of the antennas approximately 16 ft. above the street; this height would not clear numerous obstructions such as heavy tree limbs, bridges, underpasses, etc., so that broken antenna rods resulted. It became necessary to move the antennas to the side of the trucks in order to lower the overall height by about 3 ft. The communications with trucks average 6 messages per truck per month, so that their value is subject to careful appraisal.

Difficulties encountered in the operation of the central transmitter have been attributed to the antenna. During certain atmospheric conditions such as rain and electrical storms and some snow storms trouble has been experienced with the antenna switching relay flashing over during transmissions, and also a reduction in the central receiver sensitivity has occurred causing at times as much as 50 per cent to 75 per cent reduction in talkback range from the mobile units. This condition exists at the worst possible time, since radio traffic is at its maximum during storm periods. The manufacturer is working on this problem, and plans to install a different design of antenna which they believe will correct this situation.

Contrary to general belief FM radio is not entirely free from interference. Although atmospheric static does not produce noise, diathermy machines operated by doctors and chiropractors for therapeutical purposes do cause very objectionable noise if operated on or near the frequency of the FM system. We have located several interfering diathermy machines with the aid of the local F.C.C. Monitoring Officers and have adjusted the frequency of the machines off of our frequency to eliminate the noise. One of these machines was located about ¼ mile from the central station and for periods of 20 to 30 minutes throughout the day the communication system was hopelessly jammed. We are still bothered occasionally by one or more diathermy machines which we have yet to locate and correct.

Another source of interference during certain atmospheric conditions has been from other special emergency stations on the same frequency as our system. Very nearly every day during the Spring of 1945 these other stations were heard. At times the reception was 100 per cent, whereas, at other times the signal strength was just sufficient to open the receiver squelch circuit and cause noise. On several occasions the signals were so good that test calls were made with these other stations. Test calls were made with stations in Boston, Mass.; Arlington, Va.; Miami, Fla.; Corpus Christi, Tex., and Houston, Tex. Although high frequency FM radio is normally limited to short distances, there are times during certain atmospheric conditions that the signals travel thousands of miles.

Consideration is being given at present to further increasing the number of mobile units, both 1-way and 2-way, to the system. The majority of these units would be installed in heavy line construction trucks. However, there are several questionable factors with regard to such installations that will be carefully considered before a decision is made. One factor is saturation of the system during heavy traffic periods; additional mobile units would aggravate this condition, and usage of the mobile units would be limited during heavy traffic periods.

In conclusion it can be said that emergency radio usage by the company is providing "on-the-spot" rapid communication service at the scene of emergencies, not only for major catastrophes, but for the many small emergency jobs that occur each day. Radio communication results in speedier restoration of electric service and safer operation of the electrical system.

Dirty Fixtures Make Light More Expensive

THE average consumer of electricity pays for more light than he receives if he allows light bulbs to become overaged, fixtures to become dirty, or if walls and ceilings are dark and discolored.

While these factors are common knowledge among lighting engineers they are not always recognized by the consumer who pays more than is necessary for the light he gets. In a series of experiments in Birmingham, Ala., eight offices were tested by a "light meter." On the average in all eight offices, the amount of light was increased from about 12 foot candles, the foot candle being the standard unit of light measurement, to 46 foot candles by cleaning walls and ceilings, fixtures, by replacing the lamp bulbs by new ones, and in some cases by correcting voltage conditions.

Cable Fault Location

By Floyd Buck and Walter Upham
The United Illuminating Company, New Haven, Conn.

A report presented before a meeting of the Transmission and Distribution Committee, EEI, Cincinnati, O., Feb. 18-19, 1946

THIS paper is presented, not with the thought of recommending a cable fault location method, but rather to summarize fault location methods currently in use by some of the larger utilities. To obtain that data, a questionnaire was sent to a number of utilities of which 28 replied. Two of those 28 have insufficient underground systems to warrant fault locating equipment. The tabulation summarizes the methods in use by the responding companies.

The wide variety and extreme age of most of the methods in use would seem to indicate that there has NOT been sufficient improvement in fault location methods to warrant the discarding of old procedures which were developed many years ago.

The reported methods are variations of three basic ideas:

1. Localizing the fault by the use of a Loop and Bridge—some methods use a Wheatstone Bridge, others use power Bridges.
2. The use of a tracer current, or signal, which is picked up with a coil and recorded by meter or ear phones.
3. Condenser Discharge to produce a snap at the fault which can be located by listening; either directly or through a stethoscope.

Many other pieces of equipment are used, such as an ohmmeter, kenotron sets for carbonizing or for testing, motor-generator and thyratron sets for burning the fault to produce a solid ground; all of which are adjuncts to the three basic methods.

Most of the users of Loop or Bridge equipment claim that the method is satisfactory for any fault which can be burned to a good ground; that when a high resistance ground is encountered, most Loop Systems fail. It was on that account that the Kansas City Power and Light Company developed a high voltage d-c slide-wire bridge. This apparatus provides sufficient d-c voltage (approximately 40 kv) to break down almost any high resistance fault and then locate the fault in the same manner as any Loop-Bridge arrangement. (That apparatus was described in *Electrical World* for Sept. 15, 1945.) The capacity bridge which was originally developed for work on high resistance faults seems not to have been satisfactory since only two companies use it occasionally.

FAULT LOCATOR SUMMARY

COMPANY	LOOPS					TRACERS					PICK-UPS				CAPACITOR DISCH.	MISCELLANEOUS						COMPANY
	HI-V SL.WIRE	LO-V BRIDGE	WHEAT-STONE	OPEN WIRE TAP	CAPA-CITY BRIDGE	LUMDIN	WOOD PECKER	THYRA-TRON	TONE TEST	6000V AC-2a	COIL & PHONE	COIL & GALV.	LOOP & AMP.	ELECT-RODES		INSPEC-TION	CUT & TRY	OHM METER MEGGER	KENO-TRON	1500V MG SET BURNER	LUSH	
1						●					●				●							1
2	●							●				●		●					●			2
3																						3
4						●					●											4
5						●					●											5
6	●							●			●					●			●			6
7										●	●											7
8		●						●		●	●	●		●				●				8
9			●		●	●	●	●			●	●			●				●			9
10		●		●		●	●	●				●		●					●			10
11		●																				11
12									●	●	●							●				12
13	●	●	●			●	●				●					●						13
14			●				●	●			●						●	●				14
15															●							15
16		●				●					●											16
17								●				●										17
18		●							●		●											18
19								●						●	●				●			19
20						●		●			●				●							20
21	●												●									21
22			●			●					●					●					●	22
23		●																				23
24												●				●						24
25		●			●	●		●				●							●	●		25
26		●					●															26
27																●						27
28			●			●		●				●	●		●	●		●	●			28
TOTAL	4	9	5	1	2	11	5	11	2	3	14	8	2	4	6	6	1	4	7	1	1	TOTAL

The second system of using a tracer current is the most universally used with the Lundin and Thyratron methods being far and away the most popular.

The most universal method of using the tracer is to pick it up with some sort of coil or split-core and record it by ear phones. Users report that the method is satisfactory except in the case of high resistance grounds in which case the signal radiates beyond the fault and localization is impossible. The Lundin system has the advantage of being inexpensive but is limited by the low voltage used.

The condenser discharge method is rather new although C. J. Shuttleworth and L. E. Kline of the Detroit Edison Company gave an excellent paper on this method before this Committee at our May, 1939, meeting in Chicago. This was reported in detail in the minutes of that meeting. It provides for impressing a steel front wave on the cable from the discharge of a capacitor through a sphere gap. This wave front jumps the fault and discharges the condenser with a loud snap which can be easily heard, in most cases, without the aid of amplifiers. One condition is requisite: the available discharge voltage must be able to jump the fault otherwise it will merely charge the cable and slowly leak off producing no snap. This method is inexpensive. Since no commercial models are available, we have brought along a small model (5000 volts) which we use on street lighting and service cables. You may care to look at it later.

It will be noted that almost every method in use today requires a relatively low resistance to ground at the fault. To produce that low resistance, high voltage equipments have been developed (100 kv), originally for A. C., recently for D. C. With the development of high voltage vacuum tube rectifiers, such equipment became readily available. Since vacuum rectifiers are limited as to current, the amount of burning and carbonizing of which they were capable was also limited. The development of the Thyratron tube, a mercury vapor rectifier with grid control, immediately made available large amounts of high voltage direct current, which could be easily switched on and off by grid control.

(Mr. G. D. Harding of the General Electric Company is to give us a talk later this afternoon on the equipment they have developed to make this method readily available.)*

Some of you have looked askance at the section in our questionnaire referring to electronic methods of fault location. Most cable faults create a change in the characteristic impedance of the cable and as such should produce some reflection of a micro-wave pulse. An application of this principle has been made for the location of faults in telephone cables. Such an apparatus was developed by the Bell Laboratories for use on twisted pair cable and is known as a Lookator. (Mr. J. T. Schott of the Bell Laboratories, who had much to do with its development, has come here to tell us about the equipment and its application in telephone work.)*

The possibilities of applying this theory to power cables give promise of a utopian method of fault location. It would be only necessary to have a set of pictures of the typical reflection characteristic of each cable. When a fault occurred, any divergence from the standard picture would indicate the exact location of the fault. Considerable research is necessary to make the method applicable to large cables and the question of who will do that research and who will pay for it, if it is done, is at present, an unknown.

Mention should be made of the excellent presentation of fault location methods prepared by the Engineering Department of Ebasco Services in 1943 which is a comprehensive presentation of the various methods used by their member companies together with reprints from technical journals giving in detail the circuits and equipment employed.

Your attention is also called to work being done by Philadelphia Electric where Mr. Edward S. Halfman has received patents on his original method of neutralizing the effects of sheath current in his pick up device which locates cable failure with 60-cycle tracing current obtained from a 15-kv, 450-kva single phase, 100 per cent buck-boost induction regulator.

To summarize: Recent innovations to the loop and bridge method may increase its popularity but at the present time, the Lundin and Thyratron tracer current systems are the most commonly used. Coils and phones appear to be the most satisfactory pick-up method. The use of Kenotron equipment for testing and carbonizing is an accepted procedure. At present, no one system seems to fill all requirements as indicated by the fact that of 25 companies, 18 use more than one method and 11 use three or more methods. The relatively new high voltage loop and bridge, the capacitor discharge and the neutralized sheath current device are as yet almost unproved but appear to have good possibilities.

* These papers will appear in the minutes of the T & D Committee.

Boulder Dam Reservoir Is Silting Up

Between November 16, 1938, when the reservoir behind Boulder Dam was, for all practical purposes, filled for the first time, and February 23, 1945, the front of the delta of silt deposited by the Colorado River at the upstream end of Lake Meade advanced into the lake eighteen miles, writes H. S. Bell of the California Institute of Technology, in the January "Proceedings," of the American Society of Civil Engineers. This is at the rate of forty feet every day, or a foot every 36 minutes. In February, 1945, the top of the silt deposit at the front of the delta was already 260 feet above the bed rock of the river bed.

In the same "Proceedings" E. W. Lane points out that silt deposits of this kind follow the flow of the main stream of the river and that the wide backwaters of the side canyons, comprising some 20 per cent of the total storage, will eventually become isolated lakes so that earlier estimates of the life of Boulder Dam as a storage reservoir should be promptly reappraised.

Colorful Booklet on Adequate Wiring

A COLORFUL and readable booklet on adequate wiring, prepared by Public Service Electric & Gas Company, Newark, N. J., brings plenty of human interest and animation to this important subject.

Stressing the importance of installing sufficient outlets to permit comfortable living in both new and old homes, the booklet takes the reader on an illustrated room by room tour of the average home. In each, Reddy Kilowatt tells the story of just what electric service can do to provide greater comfort, help speed tedious tasks, bring better light for safety and eye comfort, and many other benefits; always provided, of course, that there are plenty of outlets for quick, convenient connecting of electrical appliances.

The Rubber Situation in Relation to Linemen's Protective Devices

By T. R. Claffy
President W. H. Salisbury Co.

Presented before a meeting of the Accident Prevention Committee, EEI, Columbus, O., Feb. 8, 1946

WAR restrictions which had been applied against the consumption of natural rubber for use in Linemen's Rubber Protective Devices were removed last November. Liberal quantities of top grade prime smoked sheet rubber was then allocated permitting manufacture of line hose, insulator hoods, sleeves and blankets together with some of the accessory items according to peacetime formulas.

Crude rubber is still held under rather tight restrictions. While relief has been granted in several important lines its use is denied in all products where reasonably good performance could be obtained from the use of substitutes. Supplies have not come to this country in the quantities that were expected by this date because of shipping problems and political unrest in the rubber growing countries. However this situation is improving and as enough crude is available for essential uses I have no apprehension over the possibility of our obtaining the quantities needed for the uninterrupted production of Linemen's Equipment.

Thus far natural rubber has served all requirements for linemen's devices in a satisfactory manner and it is in fact still the best material for this partciular use because it combines in proper balance the necessary properties of dielectric, flexibility and mechanical strength. Its only weakness is its susceptibility to corona cutting.

It is, however, characteristic of all high tensile strength natural rubber compounds to cut while under the influence of corona. Laboratory tests have produced the damage at a voltage as low as 2500. Such tests, however, were rather extreme and under conditions that a protective device would not be called upon to withstand in ordinary use.

The degree of cutting depends upon the voltage, the concentration of ozone, the time factor and the amount of mechanical strain. Unstressed rubber will cut while under the influence of corona if the concentration is high enough and the time prolonged but stressed rubber will cut at the points of strain in a matter of minutes and at comparatively low voltage. Tests made under my direction and upon blanket specimens showed no corona cutting at 25,000 volts for 108 hours but when the same rubber was stretched by 10 per cent the first signs of cutting appeared at 4500 volts and within 5 minutes. Severe cutting occurred at 35,000 volts for 1.3 minutes and again at 10,000 volts for 5 minutes. Please note again the difference in results brought out by the difference in the voltage, time and strain factors.

To date, nothing of a practical nature has been discovered in the way of processing high tensile strength rubber to resist the action of corona. To impart corona resistance it would be necessary to load the stock rather heavily with soft, plastic materials not affected by ozone such as asphalt, factice or the like but to do so would result in a mushy, low strength compound which would be entirely unsuitable for use in linemen's goods. Another way would be to protect the surface with lacquer but the thin coat would soon wear away and the surface would again be exposed.

With few exceptions of the corona trouble we have encountered was traced to improper laboratory tests where it was found that mechanical strain was exerted against the rubber at the same time that voltages of 10,000 or above were applied and usually for three minutes or more. The cases traced to the field were found to result from extraordinary or unusual applications such as when line hose was used as temporary tree guards, or when blankets were left in a covering position for a period extending anywhere from overnight in rainy weather to several days in mixed weather. I do not remember investigating a single case that involved any field use of gloves at all, or any ordinary use of other protective equipment.

Of course it would be ideal if all rubber goods could be made resistant to corona and thus cover all of the unusual contingencies that might occur.

Work is constantly being done by chemists in attempts to improve the corona resistance of natural rubber but no satisfactory solution has yet been found which would give this benefit to high tensile strength stocks. The introduction of synthetic rubber immediately attracted the attention of those engaged in the study.

At this time there are five basic types of synthetics; the Neoprenes (GR-M) Buna S (GR-S) Butyl (GR-I) Buna N's and Thiokols.

Now when considering the use of these materials in protective devices we found that advantages which each possessed were offset by distinct disadvantages.

The Neoprenes have a good resistance to ozone or corona, along with high tensile and a high degree of flexibility. Unfortunately they are weak electrically.

Buna S has a high dielectric, in fact as good as natural rubber but it is very weak in physical properties. To give it strength for its successful use in tires and mechanical goods it is necessary to load its compound with carbon black which as you know is a conductor. This simply means that as physical strength is increased by compounding its electrical strength is decreased. Moreover, Buna S has a poor resistance to ozone.

Butyl has excellent corona resistance and good dielectric. However it is poor in resilience and recovery from distortion. These objections alone make the material unsuitable for linemen's goods.

The Buna N's rates next to Neoprene in strength and flexibility. It is better than natural rubber in resistance to ozone but its electrical properties are poor.

Thiokol was developed primarily for oil and solvent resistance but it rates very low in both physical and electrical properties.

From this brief description it will be seen that none of the presently available synthetics would serve as a practical material for linemen's goods. Moreover there is no promise, or any immediate prospect, that present synthetics will be improved or that a new one will be developed which will fulfill all of the necessary requirements. The blending of the different synthetics either with one another or with rubber apparently does not accomplish the desired results.

Therefore the only approach to a solution of the problem would appear to be in the use of laminated stocks such as coating both surfaces of gloves with Neoprene and likewise coating both surfaces of blankets. With this construction the natural rubber body would give the voltage protection, together with maximum flexibility, and dependence would be placed upon the outer surfaces of synthetic to resist corona. Theoretically this would seem to be an excellent solution but the actual manufacture of such goods introduces a note of uncertainty. We positively know that gloves can be coated to a fairly accurate gauge. However the maintenance of a constant laminated thickness in molded articles such as Blankets, Insulator Hoods and Sleeves would present extreme difficulties and would be quite impossible on extruded articles like Line Hose. Other problems to consider would be the lack of a good method of test which would be adaptable to routine testing for corona resistance.

From our findings it seems apparent that the coating of rubber with a synthetic offers the only hope to a solution of the problem. Before much, if any, progress can be made it will be necessary to set up a good routine test for corona resistance which will approximate actual conditions found in the field. Lacking the experience or the knowledge necessary to devise such a test we must call upon your industry for a suitable specification. With this guide to assist us we will continue to offer our best cooperation.

Midwest Electrical Industry Representatives Attend Preview of Sales Training Program

A total of 107 executives, representing 46 utility companies, appliance manufacturers, electrical associations and leagues, attended a presentation of the Edison Electric Institute's Basic Sales Training Program, held at the Electrical League of Cleveland, Ohio, Auditorium on January 18. Several sound-slide films were shown, and information on the program presented.

The meeting was directed by M. R. Rodger, Bendix Home Appliances, Inc., and Chairman of the EEI Sales Training Committee in the early stages of development of the course, and D. M. DeBard, present Chairman of the EEI Sales Training Committee.

Other speakers at the meeting were George W. Ousler, Chairman of the Commercial Division General Committee; J. S. Schuchert, representing the Institute, and R. C. Hill, representing National Electrical Wholesalers Association, which consulted with EEI in developing the course.

Accident Prevention Committee Meeting

D. C. Stewart, *Chairman*

THE winter meeting of the EEI Accident Prevention Committee was held at the Deshler-Wallick Hotel in Columbus, Ohio, on Feb. 7 and 8, 1946.

Preliminary statistics covering the 1945 accident experience of 25 companies represented on the committee, and employing some 58,000 persons, were presented by Mr. E. J. Kreh, Duquesne Light Company. These showed:

	(25 Companies)		*(233 Companies)*
Accident Rates	*1945*	*1944*	*1944*
Frequency	10.28	8.81	11.95
Severity	1.85	1.32	1.77
Fatals per 100,000,000 hours worked	23.9	13.9	20.08

This analysis revealed the same familiar basic causes among which the most common continue to be mental lapses, failure to take all indicated precautions, and a tendency to be less alert on comparatively simple jobs. A significant fact still noted was that most of the fatalities do not occur on the most hazardous work.

A noticeable increase in lost time accidents during the latter part of 1945 was revealed in a trend study by Mr. H. O. Sprinkle, a past chairman of the Committee. This was attributed to the general labor unrest and a letdown following the end of the war.

Recommended remedial action included suggestions for stepping up interest in accident prevention through a special series of well planned safety conferences for both supervisors and workmen during which accident reports should be analyzed, work practices and safety rules reviewed, and the mutual advantages of doing the job safely stressed.

Accident Prevention work in the Consumers Power Company was described by Mr. H. J. Burton, and Mr. H. F. Webb, of the West Penn Power Company, told of the methods used effectively in his company.

Mr. E. M. Jasper, of the National Safety Council, demonstrated a "Safetygraph" developed by that organization as a visual aid for group participation in on-the-spot safety discussions.

A new sound-slide film on the basic causes of accidents, titled "Ring Down the Curtain" was announced as having been produced by the Michigan Bell Telephone Company, Detroit, Mich. It is expected to be shown at the next National Safety Congress.

The text for a Safety Conference Manual on "The Care and Use of Rubber Protective Equipment" was reported completed by Mr. E. C. Rue. This is expected to be ready for printing and distribution at an early date. A survey of industry practices in the use of such devices was also authorized and a project was initiated for setting up a uniform test procedure.

The committee endorsed a proposal by Mr. W. R. Smith that the Edison Electric Institute sponsor a research project to see if there is some drug that can be used effectively in resuscitation cases to stimulate respiratory centers and help start breathing.

Copies of the 6th in a series of Information Exchange Bulletins edited by Mr. W. R. Smith were presented. These record details in rare and unusual accidents and other items of special interest associated with the general subject of accident prevention.

A round table discussion directed by Mr. H. H. Berman, in the absence of Mr. G. Diehl, brought out much interesting and helpful information on such subjects as:

1. The correct method of sharpening climber gaffs.

2. The wearing of rings, wrist watches, key chains, zipper jackets, etc., while working in the vicinity of live lines and equipment.

3. Types of barriers or guards used for the protection of workers engaged in apparatus maintenance, etc.

4. Removal of sap wood from standing poles.

5. NSC Engineering Summary on grounding practices — Pole Mounted Distribution Transformers.

Mr. W. T. Rogers, publicity chairman, reported sales of 138 copies of the sound-slide film "Pole Top Pals," and about 1,500 copies of the committee's booklet "Fifteen Messages on Accident Prevention." Plans were also made to continue the series of monthly safety letters to Safety Supervisors in the Industry, many of whom have indicated they find these releases quite helpful in connection with their safety programs.

Mr. T. R. Claffy, president, W. H. Salisbury and Company, addressed the committee on the rubber situation and reviewed developments in the use of synthetics for linemen's rubber protective devices. Mr. Claffy indicated that while relief had been granted in several important instances, the use of crude is still restricted in all production where reasonably good performance can be obtained from the use of substitutes. He also declared that none of the presently available synthetics will serve as a practical material for linemen's goods and that there is little promise or immediate prospect that present synthetics will be improved or that a new one will be developed which will fulfill all the necessary requirements. Neither will any known method of blending accomplish the desired results. Some hope, however, was seen for improving corona resistance by covering rubber with a synthetic. Further progress on this, however, will depend upon setting up good routine test procedures approximating field conditions. Mr. Claffy invited the industry to develop a suitable specification and offered to aid in this effort.

The committee expressed appreciation for the work Mr. Claffy and other manufacturers have done to meet the needs of the industry for these products during the war and for seeing that the standards for rubber gloves were maintained.

Discussion following this presentation revealed that many companies use rubber gloves on work involving more than 3,000 volts. It was recognized, however, that in most all of these instances rubber gloves did not constitute the sole protection. For instance, a case was related in which they were used on 16,000 volts but it was explained that the men work on insulated platforms.

Mr. C. N. Rakestraw reported on plans being worked out in cooperation with the National Safety Council for the preparation of a film on Public Hazards, particularly those confronting children climbing trees, poles, towers, etc., or when flying kites near overhead power lines.

The committee also viewed a color film that stressed the importance of protecting and conserving the eyesight. This film, which is titled "Your Eyes," was produced by the Cleveland Clinic in cooperation with the Cleveland Safety Council and was shown under arrangements made by Mr. Rakestraw.

Mr. D. C. Duncan discussed the ad-

vantages of "Home Made Safety Posters" featuring items of local interest and involving little cost. He also described how he had utilized this medium effectively in his own company and recommended the method to others.

Considerable committee interest was shown in doing something to help reduce off-the-job accidents. It was recognized however, that this could probably best be accomplished by working something out with the National Safety Council. Mr. H. J. Burton was designated to represent the committee in this effort.

A report based on a survey of Hot Line Tool Practices, sponsored by Mr. George Diehl, was presented by Mr. Edwin Hansson. It was agreed that copies also be supplied to the members of the Edison Electric Institute and Pennsylvania Electric Association Transmission & Distribution groups.

A report from Mr. D. T. Lacey, Sponsor of the Speakers' Bureau service of the committee indicated that requests for such speakers are already being received.

A feature of the second day's session was a symposium on supervisory and employee training for accident prevention, led by Mr. H. F. Webb. The exchange of ideas and experiences in this discussion proved so interesting and helpful that it was agreed to include the item again on the program for the next meeting which is scheduled to be held May 6 and 7, 1946, at the Edgewater Beach Hotel, in Chicago.

T. and D. Committee Meeting

L. R. Gaty, *Chairman*

SOME 125 members and guests of the Edison Electric Institute Transmission and Distribution Committee were present at the two day meeting held at the Netherland-Plaza Hotel in Cincinnati, Ohio, on February 18 and 19, 1946.

R. R. Raberley, Standards and Specifications Group Sponsor, reported steady and substantial progress on several new standards, including proposed specifications for street lighting equipment, several line hardware items, insulators, poles, distribution transformers, etc.

The committee formally approved the "Third Report of the EEI-NEMA Joint Committee on Proposed Standards for Distribution Transformers." This report establishes design standards for certain mechanical and electrical features for three phase, pole-type distribution transformers, up to 150 Kva, 15,000 volts and below, with low voltage ratings of 600 volts and below. Following anticipated early approval by the NEMA Group, this report will be printed and distributed for commercial use.

"ASA Specifications for Wood Poles of Miscellaneous Conifer Species were reported as having been approved as a temporary war standard only, subject to review in the near future before becoming a permanent standard.

Interim proposals of the Joint EEI-NEMA Committee on Preferred Voltage Ratings up to 15,000, were reported endorsed through letter ballot by the EEI groups concerned. If NEMA action is favorable, this report is expected to be issued on a year's trial basis. It will be reviewed in the light of experience at the end of that time for possible revision and then made a permanent report.

Discussion on "War-Time Cable Operating Experience," led by T. G. Hieronymus, revealed few instances where emergency temperature ratings were approached or exceeded. Improvements noted in operating conditions included water cooling of transformers that resulted in doubling capacity; placing power cables in outside ducts; the use of lighter and less rigid joints, and reduction of sheath cracks by improved manhole design and rebuilt duct mouths. Cable faults were also reduced greatly by increased load factor, more frequent inspections, prompt patching, and use of split and sometimes flexible sleeves.

Instances were also related of cables being operated considerably above copper temperatures formerly considered the limit. As a result of these war-time operating experiences, it was suggested that perhaps temperature standards could be revised upward. This was considered inadvisable however, until more was known about the effects of such heavier loadings. At the same time, the importance of taking care of mechanical factors was stressed. Recommendations were made that economic studies be initiated on the possibility of getting more out of cable investment through greater utilization of the capabilities of modern cable.

"A Progress Report on 1944 Cable Operations," presented by E. F. Nuezel, Cincinnati Gas & Electric Company, showed a joint trouble rate of 1.1, the lowest in a six-year period. Cable failure and removal rates, however, increased to some degree over 1942 but showed improvement over 1943 experience. Additional details will be available later as further summaries are completed. Printed copies of the final report will be available later in the year.

The committee favored continuation of at least some of the features of the "Network Operations Report." The character and nature of future issues will be decided on the basis of replies to a questionnaire which will be designed and sent out by Andrew Bodicky.

A report by Floyd Buck and Walter Upham on "Cable Fault Location Methods," based on a survey of current practices, was presented by Mr. Upham; and G. D. Harding of the General Electric Company described a "Direct Method of Cable Fault Reduction and Location" for the prompt and accurate location of faults on power cable systems.

Mr. J. T. Schott, Bell Telephone Laboratories, described an instrument known as the "Lookator" for locating faults in telephone lines. This device which is based on radar principles, utilizes electrical echoes which are known to occur on telephone lines wherever there are impedence irregularities.

"Compound Migration in Paper Insulated Pole Risers" was discussed by W. C. Phillips, New England Power Service, who also told of his company's experience with "Carrier Current Propagation in the Underground Circuits" in which the telephone company interference equipment and analyzer was utilized and found a very useful tool as an aid in tracing phases in circuits and in setting relays throughout the city of Providence.

The "Network Protector Supervisory System" in use in the Oklahoma Gas and Electric Company for over four years was described by C. E. Bathe, who reported it completely reliable and its maintenance cost neglible.

A device developed by Duquesne Light Company for cleaning cable was described by M. W. Ghen, and automatic guards used around vaults by the Northern States Power Company were

described with the aid of slides by B. H. Clingerman.

Pictures of a specially designed dump truck equipped with an elevator device for cleaning manholes were shown by F. J. Raps of the Buffalo Niagara Electric Corporation. J. W. Anderson, Philadelphia Electric Company, told about a new cable grease now being tried, which greatly reduces pulling tensions.

An authoritative and comprehensive paper on "Glaze Troubles and Dancing Conductors" was presented by A. E. Davison, Toronto, Canada. R. C. Gerhartt, Buffalo Niagara Electric Corporation, told about the severe glaze trouble on his system on December 26, 1945, that caused some 200 disturbances in a single day, resulting in 317 tripouts of 66 and 110 Kv lines at 7 points, as against only two disturbances in the whole month of January. Prepared discussions on glaze and windstorm troubles were also presented by B. H. Clingerman, Edwin Hansson and C. E. Bathe.

A very interesting report on a study of 132 Kv Transmission System Losses was presented by W. H. Osterle, West Penn Power Company. Measured and calculated losses on high voltage lines of the Kansas City Power and Light Company were described by C. C. Cornelius. Discussions on Mr. Osterle's paper were also presented by E. W. Oesterreich, and by F. E. Sanford for R. O. Loomis, Georgia Power Company.

General engineering subjects under consideration were reviewed by T. J. Brosnan, Committee Group Sponsor, who announced plans for compiling composite information on General System Design Data, Communication, and Job Training.

Mr. J. W. Anderson, Chairman Subcommittee on Air Conditioning, reported that shortage of single phase motors is resulting in a flood of requests for polyphase service for 3 and 5 hp motors, where only single phase lines exist and would ordinarily be adequate. Discussion on the economic considerations generally favored retention of restricting rules. While checks made in one area revealed many cases where single phase motors could have been obtained, others reported that single phase requirements are being temporarily waived when Sales Departments are satisfied that such motors cannot be secured within a reasonable time.

Preliminary information on a partially completed load study for a typical rural area embracing a modern subdivision in the Buffalo System was provided by Mr. Brosnan.

Mr. H. E. Kent reviewed prospects for extending use of radio as a communication aid for power companies through additional frequency allocations. A report by J. P. Woodward and W. R. McMillan, describing the Emergency F-M Radio Communication system of the Union Electric Company of Missouri, was presented by Ray Robson.

A wide divergence in instructions governing the use of Hot Line Tools was noted in a report based on a survey of these practices by Edwin Hansson, Pennsylvania Water and Power Company.

Increased customer reliance on electric service was stressed by E. S. Fields as a controlling factor in solving the problems of system growth and in combating the effects of storms on lines.

The next meeting of the committee is scheduled to be held on May 6 and 7, 1946, at the Edgewater Beach Hotel, Chicago, Ill.

Electrical Equipment Committee Meeting

H. S. Fitch, *Chairman*

THE WINTER MEETING of the Electrical Equipment Committee was held February 20 and 21 at the Netherland-Plaza Hotel in Cincinnati, with about 65 members and guests in attendance.

One morning session was devoted to a closed meeting for informal discussion of apparatus troubles. There was also a brief review by some members of new equipment being added to their systems.

Mr. Wilbraham reported that ASA Standard C37.2 for Automatic Station Control Supervisory and Telemetering Equipment received final approval last December and is now available at ASA Headquarters. Revision of ASA Standard C37.1 on Relays is now in progress.

Mr. Fallon described the electrical features of the Riverside Generating Station of the Consolidated Gas Electric Light and Power Company in Baltimore. In designing this station emphasis was placed on securing a high degree of reliability, with low operating and maintenance expenditures. Operation had been most satisfactory, with the Generator Outage Factor for 1944 and 1945 only about one-quarter of one per cent. In discussion, present-day design acceptance of the importance of simplified layout was stressed, with particular reference to improving operating efficiency.

A very complete installation of prefabricated metal-enclosed switchgear in the Stamford, Connecticut, generating station was described by Mr. Lewis. Other members also cited good experience with this type of gear but mentioned that better provisions for accessibility were needed in some cases.

Mr. Shew discussed the problem of illumination in generating stations and described the design for the Southwark station. A considerable use will be made of cold cathode tubes, but the high bay lighting in the turbine room will consist of dust-tight twin incandescent and mercury units, and dust-tight incandescent units will be used in the boiler room. Generating station illumination involves particularly the adequate lighting of vertical surfaces in contrast to the more common problem of illumination of horizontal surfaces in general industry.

Mr. Morris, Chairman of the Meter and Service Committee reported a meeting of that committee last December. While this was the first meeting in about a year and a half considerable work had been accomplished during that period by correspondence, including the Bulletin on Safety Practices for Metermen, the standardization of thermal watt demand meter ratings and scales, and the standardization of bar type current transformers.

A review of demand metering for small loads was presented by Mr. Morris. It was pointed out there are a number of aspects to this problem requiring cooperation of various engineering committees and the Rate Research Committee.

Mr. Loane and Mr. Watchorn described a comprehensive probability study for the determination of frequency and duration of multiple forced outages of electric generating units. Starting with available experience data on forced outages, the method employed makes possible the estimation of synthetic forced outage experience over a long period and for any desired variations of system conditions.

(*Continued on page 96*)

RECENT E.E.I. PUBLICATIONS

Three Prime Movers Committee Reports

Turbines, Condensers and Feedwater Heaters, 1943-1944

EEI Pub. L-3. A report by the Turbines and Condensers Subcommittee of the Prime Movers Committee, Edison Electric Institute, 65 pages. Price $1.00 to members and their employees; $2.50 to non-members; and $2.60 to foreign countries.

THIS report contains statements by Operating Companies and Manufacturers on Turbines, Condensers, Feedwater Heaters, and Turbine Operating and Outage Data.

One of the major subjects investigated for this report was a review of turbine specifications. Among the companies replying to the questionnaire, there appeared to be general agreement that existing standard contract clauses were fairly satisfactory as disagreements between manufacturers and purchasers are apparently settled without undue difficulty. In negotiating for a turbine, the purchaser would do well to consider in detail whether his operating conditions will require extraordinary precautions as regards minimum load, pressure and temperature swings, standard accessories, painting of oil tanks, and other such details discussed in the statement on turbine specifications.

The fouling of turbine blading by deposits from steam carry-over continues to be a troublesome factor especially when water-insoluble silica deposits are present. The presence of this type of deposit indicates the importance of proper boiler-water conditioning to prevent carry-over, and to reduce formation of deposits. Maintenance of high-sulphate ratio in the boiler water appears to be effective in some plants. One plant states that maintenance of high-sulphate ratio appears to have some effect in eliminating deposits in low-pressure turbines. However, the extent of the effect is difficult to determine because turbines are operated part of the time at light loads and moist steam tends to remove the deposits which are formed at heavy loads.

Another company reports that continual maintenance of 5 to 1 sodium sulphate to sodium hydroxide ratio in boilers operated at 1350 psi drum pressure for a period of 17 months, has had no effect whatever in eliminating silica deposits in the high-pressure turbine.

Operating companies also present statements on special features in new and old turbines, and on operating troubles, especially with blading and vibration.

The turbine manufacturers present complete comments on the problems associated with the design and operation of their equipment, particularly on new developments.

Boilers and Combustion, 1944

EEI Pub. M-4. A report of the Boilers and Combustion Subcommittee of the Prime Movers Committee, Edison Electric Institute, 62 pages. Price $1.00 to members and their employees; $2.50 to non-members; and $2.65 to foreign countries.

THIS report contains statements by Subcommittee, Operating Companies and Manufacturers on:

- Boiler-Pressure Parts
- Boiler Cleaning (External and Internal)
- Burner Performance
- Maintenance (Non-Pressure Parts)
- Furnace-Tube Corrosion

and statements from Manufacturers on:

- External Boiler Cleaning
- Dust Collectors
- Boilers, Superheaters, Furnaces and Airheaters
- Oil and Gas Burning Equipment
- Stokers
- Combustion Control

The report notes that difficulties in connection with pressure parts do not appear to have been of a critically serious nature. Some tube failures and tube-seat leaks are reported but causes and satisfactory remedies have been found in most cases. Considerable handhole leakage has occurred and, as usual, there is wide divergence of opinion as to which type of gasket material is the best. In some installations, frequent gage-glass failures are experienced while in others satisfactory life is reported. Superheater-tube failures have been overcome by increasing steam velocity and by reducing carry-over. Economizer tube failures have been infrequent and air-heater troubles of minor importance.

External cleaning continues to be a major problem. Mass-type, telescopic and retractable-type soot blowers are often favored over hand lancing and are reported on favorably by several companies. Maintenance on these blowers is reported in instances to be somewhat high. Wider tube spacing of later units has greatly reduced the labor of external cleaning.

Need for internal cleaning is reported in many cases but improved methods of feed-water and boiler-water treatment have greatly reduced the seriousness of this problem. Chemical cleaning is being used more extensively with satisfactory results in most cases but improvement in method and lowering of cost is expected.

Many burner changes have been made to obtain better distribution of the products of combustion. Pulverized-coal burners have given the most trouble but even some natural-gas and oil-burner installations have required modifications and adjustments.

Of the companies using pulverized fuel about half have been adversely affected by poorer quality of coal. Higher moisture content and lower grindability reduce mill capacity. Heating surfaces slag more rapidly with poorer grades of coal.

Special outages for maintenance of non-pressure parts are seldom required. Such repairs can usually be deferred until the unit is taken out for scheduled maintenance. Both metallic and refractory baffles have given some trouble. Chrome-ore deterioration on slag-top furnace floors and related equipment has been mentioned frequently in the replies. High iron content in the molten slag appears to have a solvent effect on chrome ore. Metallic supports for superheaters and baffles have required considerable maintenance, especially in cases where proper alloy materials were not obtainable.

External furnace-tube corrosion continues to require attention in certain installations but development of means for protection of wall tubes or correction of tube deterioration before it has progressed too far have practically eliminated forced outages from this cause. Causes for this trouble (thus far encountered only in pulverized coal-burning boilers) apparently involve wall flame impingement, low excess air, and fairly high sulphur content in fuel, and presence of molten slag in the furnace. Installations using a dry-bottom furnace and/or horizontal turbulent burners, appear to have been largely free from severe furnace-tube corrosion.

Boiler Auxiliaries, 1944-1945

EEI Pub. M-6. A report of the Boiler Auxiliaries Subcommittee of the Prime Movers Committee, Edison Electric Institute, 39 pages. Price $0.70 to members and their employees; $1.75 to non-members; and $1.90 to foreign countries.

THIS report contains statements by the subcommittee, operating companies, and manufacturers, covering operating and design problems related to boiler auxiliaries which are of particular concern to operators of steam generating equipment at this time, together with descriptions of new developments.

Boiler Feed Pump Corrosion-Erosion Investigation

There has been no reported case of corrosion-erosion failure of 5 per cent or higher chromium boiler feed pump parts. While a few users have eliminated the trouble by changing feedwater conditions, such as raising the pH with recirculation or feeding sodium dichromate periodically, the great majority of trouble cases are being corrected by the installation of alloy steel parts or by depositing alloy filler metal on existing carbon steel parts.

Boiler Fan Capacities

In recognition of difficulties encountered in selection of proper draft fan sizes for power station boilers, the committee has initiated a study to produce ultimately a correlation of answers which will be of service to the industry.

Replies from 30 operating companies indicated no general increase in induced draft fan maintenance and little change in boiler output during the past two years. The large number of variables in construction and operation of a fan installation makes it difficult to evaluate the effect on maintenance of any one item.

Operators are pleased with the operation of the electric coupling, and the Committee is sure that this equipment will stay successfully on the market.

Most companies reporting prefer motor drives for the induced draft fans, forced draft fans, pulverizer exhausters and pulverizer mills, with sequential starting and tripping interlocks.

Automatic lighting of ignition burners is accepted as satisfactory on many boilers burning pulverized fuel, as an operating convenience in speeding up ignition under certain circumstances.

No appreciable difficulty appears to be encountered, except in lubrication of the ringed gear of the Hardinge-type pulverizer.

Reports on operation of automatic feed-water regulators from 23 companies indicate that they are in general satisfactory.

A growing interest in dust control for coal storage piles and conveyor systems, and a need for better means of handling frozen coal, are noted in the information received from 23 operating companies.

Germany to Be Stripped

(*Continued from page* 82)

level through being allowed (1) a quota of materials per quarter or per month for maintenance and (2) material for additions only after prior approval of the Utilities Director. Close control and supervision of deliveries of manufacturers, warehousers and importers would be essential.

The electrical manufacturing industry's machine tools for making heavy equipment could be removed. Drastic application of this type of control could transform German manufacturers into light equipment makers exclusively.

Field inspection staffs will have to carry the full burden of insuring enforcement. Alternative legalistic devices employed by the WPB could not be relied on in occupied Germany.

Each of these problems in materials control is a major operation involving large quantities of material and a long series of executive decisions, supplemented by field inspections.

The proposed Utilities Director should be responsible for the power supply of the whole of Germany, and should be provided with a staff of power specialists to plan and supervise the job. His work will be speeded and made easier, the Committee believes, and its success more sure, if it is undertaken during the period of Allied military occupation. Whether effective control can be maintained after the occupation depends upon the terms of the Peace Treaty.

Post-War Power Requirements

Germany's aggregate energy consumption is estimated for post-war years as 28.5 billion kilowatt-hours. Allowance for system losses and for continued net imports of energy from Switzerland and Austria results in requirements for generation within Germany in an amount of 32 billion kwh.

The Committee feels that this represents a generous allowance for the energy likely to be required in future years, allowing as it does for prosperous economic conditions.

It is estimated that a system peak load will be an evening peak on dark winter days of about 8,150,000 kilowatts for the integrated system covering Germany. A reasonable allowance for the contribution of imports of power toward meeting that peak, and for the reserve generating capacity that should be provided, indicates that the total generating capacity necessary to support the estimated consumption is a round figure of 9 million kilowatts.

But the reduction of Germany's capacity to produce electric power will contribute to reduction of Germany's industrial potential only if there is the closest possible coordination between the program for limiting power facilities, and the program for general reduction of the industrial potential. Removal of power facilities, however drastic, relates only to the present; it would not influence the German capacity to produce power in the future unless the capacity to manufacture those power facilities is also removed or reduced. Similarly, removal of power facilities to a degree that leaves Germany enough capacity to operate a peaceful economy would not reduce her industrial potential, if such fields as steel, aluminum and electro-chemicals were left with excess manufacturing capacity.

Germany once made a notorious choice between guns and butter; a future Dr. Goebbels might persuade his people to choose between electric power for their homes, and power for the plants turning out bigger, better guns.

What Safety Begets

(*Continued from page* 78)

keep priming the safety program unceasingly. He should personally stand ready to render active cooperation on safety work and should make sure that every employee under his supervision also cooperates to the fullest extent in the prevention of accidents. He should brook no halfway tendencies. Lip service is definitely inadequate. He should settle for nothing less than full participation from the entire organization. In throwing the full weight of his personality and position behind accident-prevention measures, an operating supervisor seeks to derive the freedom from disturbing woes that safety begets.

PERSONALS

FRANCIS J. GANNON, vice president and general manager of the Tampa Electric Co., since 1931, has been elected president to succeed Col. Peter O. Knight, organizer of the company. MALCOLM R. MCKINLEY, the company's general superintendent since 1928, has been named vice president.

Mr. Gannon has had a long and active career in the utility business, having started at the age of 15 as a messenger in the office of Stone & Webster, in Boston. Leaving Boston, he joined the Dallas Power & Light Co. and subsequent connections followed with the Pawtucket Electric Co., Pawtucket, R. I., the Edison Illuminating Co. of Brockton, Brockton, Mass., the Sierra Pacific Power Co. of Reno, Nev., and the Northern Texas Traction Co. at Fort Worth. Mr. Gannon first went to Tampa in 1926 as vice president and treasurer of Davis Island, Inc. He was then called to the presidency of the El Paso Electric Co., returning to Tampa in 1931 as vice president and general manager of Tampa Electric Co.

Col. Knight, who observed his eightieth birthday on December 16, retires as the company's president after 53 years of continuous service. Through him Tampa was one of the first cities in the United States to receive electric light and among the first in the country to have electric street cars.

Mr. McKinley became identified with the Tampa properties in 1928 as general superintendent. He had been assistant to the vice president of the Narragansett Electric Co. and was also previously connected with the Lowell Electric Light Co., Lowell, Mass.

JUSTIN R. WHITING, President of the Commonwealth and Southern Corporation has announced that W. J. HERRMAN, formerly vice president of Telephone Bond and Share Company of Chicago, has joined the organization of Commonwealth & Southern (New York), a mutual service company, as rate analyst.

An engineering graduate of the University of California in 1922, Mr. Herrman spent his first years after college with the Westinghouse Electric Company and the Great Western Power Co. of California. In 1933 he became a partner in the investment firm of H. R. Baker and Co. and as a result of this combination utility-financial background, was frequently employed as an expert on rate of return, cost of money and related subjects. In 1937 and 1938 he was called to Washington by the Federal Communications Commission to assist in the preparation of basic studies on rate of return in the telephone industry.

Subsequently, he has been engaged in rate analysis and joint accounting matters between telephone systems for Telephone Bond and Share Company and its affiliates.

In announcing Mr. Herrman's association with the Commonwealth companies, Mr. Whiting pointed out that the next decade may witness a growth in the use of electric power and gas comparing favorably with any like period in history. In such circumstances, the development of rate schedules which will attract and retain this expected volume of business, while at the same time producing a return sufficient to obtain the new capital needed for property additions, may become one of the most important problems faced by the industry in the post-war era.

Mr. Herrman assumed his new duties on March 1st at the offices of Commonwealth & Southern, 20 Pine Street, New York City.

The voluntary retirement as of May 1 of H. I. BABBITT, Manager of West Penn Power Company's Western Division has been announced by Vice President P. H. Powers. Although Mr. Babbitt has not yet reached retirement age, he asked to be relieved of the strenuous activities required in his position as Division Manager to have more time for leisure and travel while still able to enjoy it.

In announcing Mr. Babbitt's forthcoming retirement, Mr. Powers stated that the new Western Division Manager will be J. V. SOISSON who, since February 1, has been Assistant Division Manager of the Company's Central Division, with headquarters at Charleroi.

Mr. Babbitt was employed as Groundman over 44 years ago with the Washington Electric Light and Power Company, a predecessor company of West Penn. He was sent to McDonald in August, 1911, as District Manager of the Citizens' Electric Light, Heat and Power Company, and a year later was assigned to the Washington Electric Light and Power Company as District Superintendent. He was appointed Western Division Manager for West Penn Power in April, 1924, which position he has held since that date.

Mr. Soisson, new Manager, for the Company's Western Division, is a graduate of the University of Notre Dame, Class of 1926, with the degree of Bachelor of Science in Electrical Engineering. Following his graduation, he came with West Penn in July, 1926, as a Cadet and moved around the System for training. On June 1, 1927, he was appointed Superintendent of the Scottdale District and remained there until February 1, 1935, when he was named District Manager at Connellsville. His tenure there continued until his assignment last February to the Central Division Assistant Managership.

JOHN W. DRUMMOND has been appointed assistant superintendent of overhead lines department of The Detroit Edison Company.

Mr. Drummond came to the company in 1929 as an electrical engineer from Cornell and has been in charge of the technical division of the overhead lines department.

FRANK E. SANFORD, Superintendent of Distribution Engineering of The Cincinnati Gas & Electric Company, has resigned to join the editorial staff of *Electrical World*, in the Chicago office.

Starting with the Cincinnati utility as a cooperative student while attending the University of Cincinnati, he continued after graduation with an electrical engineering degree in 1926. Following a period as engineer on layout of industrial substations, he advanced to transmission engineer and later to distribution engineer, with supervision of planning and construction layout, transformer operation and voltage control. As superintendent, his department has also included structural design, right of way, and load analysis and system planning for distribution and transmission.

Mr. Sanford was chairman of the Edison Electric Institute Transmission and Distribution Committee in 1943-45, and is a member of two EEI-NEMA

Joint Committees—Standards for Distribution Transformers and Preferred Voltage Ratings. He is the author of "Electric Distribution Fundamentals," published by McGraw-Hill Book Company in 1940, and of numerous articles and papers on distribution. Material in the text book was developed during ten years' experience instructing evening classes conducted in the Company organization.

A member of American Institute of Electrical Engineers, he is at present on a subcommittee to study professional activities and relationships with other engineering bodies. Also a member of The Engineering Society of Cincinnati, he has been a director and on several committees and is a past president of the Technical Societies Council of Cincinnati.

JAMES S. MOULTON has been named executive engineer of Pacific Gas & Electric Co. to succeed the late W. G. Vincent, vice president and executive engineer.

A graduate of Yale University Sheffield Scientific School in 1920, Mr. Moulton has been successively a member of the operating department of San Joaquin Light & Power Corp., executive engineer for Great Western Power Co., and, following those companies' mergers with P. G. & E., in 1930, he held the position of assistant to the vice president and general manager of P. G. & E. until 1940. After that time he was in the executive engineer's department until his entry into the service in 1942, from which he has recently been released with the navy rank of commander.

NUMA VIDAL has been appointed manager of the Sharon division of the Pennsylvania Power Co. to succeed RUFUS MOSES, who has recently joined the Ohio Edison Co. in the capacity of Youngstown division manager. Mr. Vidal was formerly superintendent of power sales for the company. His first employment following graduation from the University of Colorado was with the Duquesne Light Co. as a power sales engineer. In 1927 he joined the Penn-Ohio Power & Light Co. in Youngstown in the same capacity. When the general office of Pennsylvania Power Co. was established in New Castle in 1931, Mr. Vidal was made superintendent of power sales.

A. W. WALTON, for the past ten years protective engineer, generation department, Oklahoma Gas & Electric Co., has been appointed electrical engineer, generation department. Mr. Walton will be responsible specifically for the relay department, dispatching office, and electrical operation and maintenance at the power plants in cooperation with the plant chief engineers. Succeeding Mr. Walton as protective engineer is GERALD E. BROOKS, relay engineer for more than eight years.

ROBERT G. OLMSTED, formerly treasurer of the Long Island Lighting Co., Mineola, N. Y., has returned to the company after three and one-half years of service with the United States Army Air Forces. He has been appointed vice-president of the company and of the Nassau and Suffolk Lighting Co. and assistant to the president of the Queens Borough Gas & Electric Co.

JOHN D. WADDELL recently became associated with the Delaware Power & Light Co. as assistant operating manager—electric. Mr. Waddell goes to the Delaware utility direct from active duty as a lieutenant commander in the U. S. Naval Reserve. His electrical background is varied in that he has been employed in the past by the Louisville & Nashville R. R. Co., the Jones & Laughlin Steel Corp., and as a licensed electrical contractor. Prior to entering the Navy in 1942, Mr. Waddell had been associated with the Duquesne Light Co., Pittsburgh, Pa., for more than eight years as electrical engineer in the distribution department.

CHARLES E. RODEN has returned to Southwestern Gas & Electric Co., Shreveport, La., after serving for five years in the United States Army. Floor sales manager in the Shreveport division merchandising department before entering the service, Mr. Roden has been appointed residential sales manager.

M. H. PRATT has been appointed chief engineer of the Central New York Power Corp., Syracuse, N. Y., succeeding the late Albert W. Andrews.

Following graduation from the University of Pennsylvania, Mr. Pratt started in the subway department of the Syracuse Lighting Co., Inc., and successively served as assistant to the distribution engineer and assistant engineer of the electrical department. In 1929 he was made engineer of the electrical department.

When the Syracuse company joined the Niagara Hudson Power System, Mr. Pratt was appointed assistant to the engineer for the central division of the system. In 1937 when companies in this division merged to form Central New York Power, Mr. Pratt was appointed electrical engineer for the corporation. He also served as assistant to Mr. Andrews.

As chief engineer, Mr. Pratt will direct a department which is responsible for the design of electric and gas systems, for various special studies and research, establishment of construction standards, engineering records and budgets, and the application of new methods to production and distribution of electric power and gas.

HARRY FERGUSON has been appointed operating manager of the Pennsylvania Power & Light Co. For a number of years he had been assistant to the late N. G. Reinicker, vice president and general manager.

In his new position, Mr. Ferguson will have charge of the company's plant betterment department; the generation department, which operates 17 steam and a number of hydro stations; the system operating department; the test department, and a number of others.

Mr. Ferguson joined the P. P. & L. in 1920 as technical engineer of power plants. Prior to that he was employed by the Hope Natural Gas Co. and the New Jersey Zinc Co.

He was born in New Cumberland, W. Va., and was graduated from the University of West Virginia in 1916 as a mechanical engineer. He has just completed a two-year term as chairman of the General Section, Pennsylvania Electric Association.

E. W. FLORENCE, who has been manager of the Sacramento, Calif., division of the Pacific Gas & Electric Co. for 25 years, retired January 1, ending more than 45 years of service with that company and its affiliates. Mr. Florence began his electrical career in 1901 at Chico, Calif., where he became branch manager, and was later transferred to Fresno in 1909 and to San Mateo in 1911. He assumed the position as division manager at Sacramento in 1921. L. J. BRUNDIGE, former Chico division manager, will replace Mr. Florence in

the Sacramento division, while W. R. BOWLER, sales manager at Sacramento, will fill Mr. Brundige's place at Chico. Other appointments include W. L. GREER, who will be the new sales manager of the Sacramento division.

Five changes in personnel have been announced by Puget Sound Power & Light Co.

CHARLES BORING has been transferred to Seattle where he will be assistant to the general superintendent of operations. For the past 14 years, he has been at Everett, first as assistant superintendent of light and power, then superintendent. His successor at Everett will be J. L. MARZLUFF.

Mr. Marzluff served as company transportation coordinator during the war. He has been with the company for 33 years, starting as a lineman in Bellingham in 1912. Among his other positions have been manager of the Renton and Winslow local offices and assistant superintendent of light and power at Bremerton.

FRANCIS H. FERGUSON, superintendent of light and power of the Western Division at Bremerton, has been moved to Seattle where he will hold the same position in the Central Division.

ALBERT M. MCDONALD, superintendent of distribution in the Central Division, has succeeded Mr. Ferguson as superintendent of light and power for the Western Division. Mr. McDonald started with Puget Sound in 1925 as a lineman. He has been a line foreman, general foreman, and assistant superintendent of the Southern Division.

FRANK M. DREBICK has succeeded Harold Harmony as manager of the Winslow branch office.

Electrical Equipment Committee

(*Continued from page* 91)

The factors entering into the determination of reserve requirements for an interconnected system were discussed by Mr. Phillips. He mentioned that the change in shape of yearly load curves and the trend to unit turbine-boiler installations may lead to the necessity of installing additional capacity to provide for scheduled maintenance. In discussion, the point was made that the continual urge to economy in operation will result in new installations of more efficient units and the shutting down of older units which will be available as reserve.

CONVENTIONS AND MEETINGS

MARCH

1	American Society for Testing Materials, Pittsburgh, Pa.
10-14	North Central Electrical Industries, Radisson Hotel, Minneapolis, Minn.
11-12	Oklahoma Utilities Association, Annual Conference, Biltmore Hotel, Oklahoma City, Okla.
14-15	Southeastern Electric Exchange, Engineering and Operation Section, Birmingham, Ala.
22-23	Southeastern Electric Exchange, Accounting Section, Vinoy Park Hotel, St. Petersburg, Fla.

APRIL

1-3	Meeting of Gas and Electric Industry Accountants, Netherland Plaza Hotel, Cincinnati, Ohio.
1-3	The American Society of Mechanical Engineers, Spring Meeting, Chattanooga, Tenn.
1-4	Twelfth Annual Sales Conference, EEI, Edgewater Beach Hotel, Chicago, Ill.
3-5	Midwest Power Conference, Palmer House, Chicago, Ill.
8-12	National Electrical Manufacturers Association, Spring Meeting, Palmer House Chicago, Ill.
10-12	Missouri Valley Electric Association, Engineering Conference, Hotel Continental, Kansas City, Mo.
19-20	Wisconsin Utilities Association, Annual Convention, Loraine Hotel, Madison, Wis.
21-25	National Electrical Wholesalers Association, Stevens Hotel, Chicago, Ill.
24-26	Southeastern Electric Exchange, Annual Conference, Edgewater Gulf Hotel, Edgewater Park, Miss.
29-May 1	Chamber of Commerce of the U. S. A., Atlantic City, N. J.

MAY

6-7	Accident Prevention Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
6-7	Electrical Equipment Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
6-7	Hydraulic Power Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
6-7	Prime Movers Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
6-7	Transmission and Distribution Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
14-16	Southeastern Electric Exchange, Home Economics Conference, Atlanta, Ga.
23-24	Southeastern Electric Exchange, Power Sales Conference, Asheville, N. C.
28-29	Pennsylvania Electric Association, Engineering Section, Penn Harris Hotel, Harrisburg, Pa.

JUNE

3-5	EDISON ELECTRIC INSTITUTE, Waldorf Astoria Hotel, New York, N. Y.
3-6	National District Heating Association, The Cavalier, Virginia Beach, Va.
3-6	National Fire Protection Association, Hotel Statler, Boston, Mass.
17-19	National Electrical Manufacturers Association, The Homestead, Hot Springs, Va.
26-28	Canadian Electrical Association, Annual Convention, Banff Springs Hotel, Banff, Alberta, Can.

SEPTEMBER

15-18	Controllers Institute of America, Commodore Hotel, New York, N. Y.
18-21	Illuminating Engineering Society, National Convention, Chateau Frontenac, Quebec, Can.

OCTOBER

7-11	American Gas Association, Atlantic City, N. J.

Re-establishment of contact with a number of foreign correspondents was reported by Mr. DeBeech with the present list totaling 10 in eight countries. Mr. DeBeech presented a report obtained from the Metropolitan-Vickers Company regarding an oil circuit breaker with provision for continuous oil filtration for electric furnace applications.

A report was received from Mr. Seelye, EEI Chairman of the EEI-NEMA Joint Committee on Preferred Voltage Ratings for A-C Systems and Equipment, stating that a favorable response had been secured to the letter ballot on issuance for a year's trial of the interim report covering voltages up to 15 kv. The NEMA representatives had not yet completed the letter ballot of their members.

Mr. Gross summarized the results of a study reported at a recent Doble Conference, which showed that most companies tested and maintained equipment during the war period generally in accord with their usual practice. War time experience emphasized the value of preventive maintenance and developed no need for any major changes in procedures.

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(Continued)

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J. H. POLHEMUS.....Portland General Electric Company, Portland, Ore.
P. H. POWERS.....West Penn Power Company, Pittsburgh, Pa.
C. C. SMITH.....Kansas City Power & Light Company, Kansas City, Mo.
FRANK M. WILKES.....Southwestern Gas and Electric Company, Shreveport, La.

(Executive Committee)

The Executive Committee consists of the following members of the Board of Directors: Messrs. W. C. Bell, H. B. Bryans, W. H. Burke, William Kelly, P. H. Powers, W. H. Sammis, E. C. Stone, P. S. Young.